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EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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American Fern Journal

Vol. 12 JANUARY–MARCH 1922 No. 1.

Occurrence of Botrychium matricariaefolium in New Jersey

BAYARD LONG

The meager general knowledge on the occurrence of *Botrychium matricariaefolium*[1] in New Jersey and the consequent caution with which the species is accredited to the state in the most recent work covering this area—Mr. Norman Taylor's *Flora of the Vicinity of New York*—suggests the propriety of placing on record a more detailed and convincing statement of the verity of the reports published there, together with an account of certain older published records and of a goodly number of additional stations more recently discovered.

There are but these two stations admitted in the *Flora of the Vicinity of New York*:—

"N. J. Cranberry Lake, Sussex Co. (according to Mackenzie); reported from near Riddleton, Salem Co."

From the care shown in the form of citation it might

[1] The Matricary Grape Fern is currently known in America under three names: *Botrychium neglectum* Wood, *B. matricariaefolium* A. Br., *B. ramosum* (Roth) Aschers. *B. neglectum* Wood is used by those who consider the American plant different from the European—a contention which has been upheld by various students, but has never been conclusively demonstrated. If the plants are considered to be conspecific, one of the other two names is to be employed. There is no possible doubt about the application of *B. matricariaefolium* A. Br., but this name is long antedated by *Osmunda ramosa* Roth, if that plant was really the same. There is apparently no extant type and *B. ramosum* (Roth) Aschers. is applied to the present plant (rather than to *B. Lunaria*) upon the basis of a very complicated argument, the verity of which is by no means entirely obvious. I am indebted to Mr. C. A. Weatherby for a comprehensive account of the status of these names. The above is a brief summary of a matter entirely too technical to be considered in this place.

[Vol. 11, No. 4 of the JOURNAL, pages 97–130, plate 2, was issued March 31, 1922.]

readily be conjectured that these records are based upon report alone. It may be stated at once, however, that they are both supported by authentic material.

The absence of any reference to the records in Dr. N. L. Britton's *Catalogue of Plants Found in New Jersey* attracts attention—especially in a work, such as Taylor's, giving careful consideration to all published records. They must have been omitted surely through oversight or accident. There are three records for the species published here in 1889:—

"Morris: Big Swamp, Madison—F. J. Bumstead. Sussex: Kittatinny Mt. near Walpack Centre—Britton & Rusby. Bergen: Tenafly—Leggett."

The bases of these records naturally would be searched for in the State Herbarium, built up by Dr. Britton when upon the New Jersey Geological Survey, which is now in the care of the New Jersey Agricultural Experiment Station at New Brunswick. A recently obtained opportunity to examine the Botrychiums in this valuable collection—for which my thanks are due to the courtesy of Dr. Melville T. Cook—makes it possible to give detailed information about two of these records.

The Britton & Rusby material consists of a single specimen. This is a complete plant, in full maturity, about 14 cm. high, with very reduced frond. The sterile segment is lanceolate, shallowly few-lobed and is borne near the summit of the plant, closely clasping the fertile segment. This is the form that has been named *B. tenebrosum* A. A. Eaton—which, if not given distinctive rank, is to be referred, apparently, to *B. simplex.* The Bumstead record is based upon a sheet of four specimens, three of which are characteristic *B. matricariaefolium* but the fourth is *B. angustisegmentum.* The label reads: "Big Swamp, Madison, N. J., July 1866." It would seem not unlikely that both species

were collected together.[2] Unfortunately the search for the Leggett material from Tenafly has been unsuccessful. Dr. Britton, who distributed the Leggett Herbarium, has kindly written me that it is not in the collection at the New York Botanical Garden, though many of Leggett's specimens are preserved there. He would have supposed that it had been sent to the New Jersey Geological Survey, but if not there, his only and final suggestion is that it may have gone to some private collection.

Of Taylor's citations, the Riddleton record[3] represents the first known station for the species in southern New Jersey and for more than a decade the only station in this portion of the state. There are two sheets of specimens of the plant in the Herbarium of the Philadelphia Academy, obtained at several times between 1894 and 1896 by different collectors. The material ranges from tiny plants of 4–5 cm. to well developed specimens of 20 cm. height. It appears that the plant was discovered at Riddleton by Mr. C. D. Lippincott of Swedesboro, who at that time was doing much original exploration in this part of New Jersey. This interesting discovery was at once shared with the Philadelphia botanists, and collections, made by Stewardson Brown, Joseph Crawford, and C. D. Lippincott, are preserved in the Academy Herbarium. The finest is that made by Mr. Lippincott July 4, 1896, a portion of which is also

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[2] There is, however, an added complication, which may be put upon record, that on this sheet is another label (a small pencilled ticket) reading: "Englewood, May 23, 74." The *B. matricariaefolium* is in long over-ripe condition and the *B. angustisegmentum* in fresh maturity: this would be appropriate for these two species in July in upper New Jersey. The early date of May 23 is quite impossible for plants in the condition of maturity shown by these specimens and the view is here taken that this ticket has been misplaced and is not appurtenant. *B. angustisegmentum* is known from other collections to occur in Morris County and the two species, as is well known, not infrequently grow together—*B. angustisegmentum* maturing about a month later than its ally. In the consideration of these several specimens from the Herbarium of the New Jersey Geological Survey I have had the corroboration of Mr. Weatherby.

[3] Keller & Brown, Fl. Phila. & Vic. 8 (1905).

contained in his private herbarium at Swedesboro, New Jersey. Since then the plant apparently has been lost sight of at Riddleton. In the spring of 1917 Mr. Lippincott guided me to the exact spot but the species was not found. The station, immediately south of the railroad stop, is in low woods (characteristically of Pin Oak) with very thin humus overlying a clayey, gravelly subsoil, and probably is continuously wet during the growing season of the grape fern. *Ophioglossum vulgatum* formerly grew in this same spot, and as it has since been found in two other nearby areas at Riddleton, probably the grape fern also will be rediscovered in time.

Not until the summer of 1905, apparently, was the species again seen in the state. From the energetic collecting of the late Professor C. S. Williamson of Girard College, Philadelphia, this unpublished record is to be obtained. At the Philadelphia Academy there is a sheet of two specimens bearing the label: "Sanatorium, Bethesda, Morris County, N. J., Aug. 2, 1905." In his own large private collection, now incorporated in the Herbarium of the Academy, there is additional material of the same collection.

Taylor's record for the northernmost county of the state follows here, chronologically. Through the kindness of the collector, Mr. Kenneth K. Mackenzie, I have been enabled to examine the basis of this record. The label reads: "Rich soil in rocky woods, Cranberry Lake, Sussex Co., N. J., June 9, 1907." Mr. Mackenzie tells me that a single plant was found in the woods bordering the lake, about a mile south of the railroad station. The specimen was verified by Miss Margaret Slosson several years ago at the New York Botanical Garden and is in the herbarium of Mr. Mackenzie at Maplewood, New Jersey.

During the Botanical Symposium held at Newton in July 1907 the species was found at least once. In Dr.

Philip Dowell's account[4] of the meeting he notes it reported July 5, which day was spent on a trip to Swartswood Lake. There is material consisting of five good specimens at the Philadelphia Academy, labelled, in the hand of Mr. S. S. Van Pelt (who wrote the labels of most of the Symposium specimens deposited at Philadelphia) "Hillside between Swartswood and Newton, Sussex Co., N. J., July 5, 1907, S. Brown."

The plant seems not to have been collected again till 1913, when Mr. Harold Pretz and myself, on June 15, each succeeded in discovering a single specimen during the day's collecting along the Pequest River, southwest of Springdale, in Sussex County. Mr. Pretz's material, in his own herbarium at Allentown, Pa., is from "woods bordering wooded swamp." The data with my own specimen (probably from the same general vicinity) indicate "dryish maple woods"—the station coming to mind as a well-drained, gentle slope, with scanty undergrowth, lying between limestone cliffs and a wooded swamp. Both specimens are finely developed ones, my own measuring 26 cm above the ground. This same year and month Mr. Mackenzie continued the precedent of a single plant to a collection in discovering a specimen along the Delaware River, a couple of miles above Water Gap station. The material, in the collector's herbarium, is labelled: "Dry slopes above Water Gap, Warren Co., N. J., June 23, 1913." It has been examined by Miss Slosson.

During the explorations for Dr. Witmer Stone's *The Plants of Southern New Jersey* it had been realized what a host of characteristically upland species were waiting to be discovered in the northern corner of Burlington County. Here, previously to 1911, had been found such unusual plants for a coastal plain area as *Ostrya virginiana, Hydrangea arborescens, Chenopodium Bos-*

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[4] Dowell, Torreya, vii, 167 (1907).

cianum, Viola rotundifolia, and *Galium lanceolatum.* Consequently, after more or less continuous work in this region, the detection of *B. matricariaefolium* here in 1915 at two localities had lost somewhat the element of surprise which it would have occasioned some years earlier.

The discovery of the plant May 12 along Blacks Creek, southeast of Bordentown, is connected with an incident familiar enough to all collectors but never becoming commonplace. I had been collecting along the steep slopes bordering the creek, and desiring a comfortable spot to put in press an armfull of various specimens, I climbed to the crest of the slope, and on a grassy spot, under scattered trees, by a rill, sat down, opened my press and found the grape fern almost under my hand. Search as I might, however, only two small specimens could be found. The other station is along the Delaware River at Kinkora. There are several streamlets here which have cut narrow gullies through the steep terraces of the Delaware. Exploration, on several occasions, of the rich wooded slopes of these gullies has invariably brought to light upland species of special interest to southern New Jersey. To an already considerable list was added *B. matricariaefolium* on May 27. The underlying soil of these slopes is clayey and the rich humus from an abundant vegetation often slides from the steeper portions and collects on the more level spots. In such a habitat was found a small colony of the grape fern. Most of the specimens were of medium size, the largest being 15 cm. high.

The botanizing in early spring often consists more of exploration than of actual collecting, and at least a cursory examination is frequently given many a spot which later in the season would escape notice. The green slopes of an old pit near Sewell, in Gloucester County, brought to recollection, on a wintery day in

April 1916, the long-standing query whether the green sands of the Marl Belt do not harbor some peculiar species. This glauconite exposure, on being followed, led into moist, rich, marly woods along a rill tributary to Mantua Creek. The very first discovery was the pale-green, closely folded-up fronds of *B. matricariaefolium*, standing out conspicuously above the brown woodland carpet of dead leaves. Over a dozen plants had already come to sight, but the tallest had scarcely attained 5 cm. and most of those detected were just appearing above the ground. As it seemed not unlikely that the colony might prove to be larger than was then apparent, it was again visited, on Memorial Day, and found to cover a much greater area and to contain about three times as many plants. Excellent specimens as tall as 25 cm. were collected this date, May 30.

There are few places in southern New Jersey more familiar to Philadelphia botanists than Clementon—probably because here in Camden County the edge of the fascinating Pine Barrens approaches nearest to the city. A genuine surprise was experienced in 1919 in finding this grape fern at Clementon in dry, open, sandy thickets on the border of pine woods. By all precedents it should be absent from the Pine Barrens, but the associated Pitch Pine, Sassafras, Sweet Fern and Bracken are the characteristic types of the nearby, undoubted Pine Barrens. However, equally near was a marshy spot of the Middle District[5] with such characteristic species as *Panicum microcarpon*, *P. clandestinum*, *Habenaria lacera*, and the rare *Geum strictum*. And moreover, the prevalence of Green Brier about the grape ferns indicated the Middle District. A half-dozen or more plants, appearing like little clenched fists, already had pushed through the loose sand on April 14. When the colony was seen a month later

[5] See Stone, The Plants of Southern New Jersey. Ann. Rep. N. J. State Mus. 1910, 57 (1912).

about double the number of plants was found and the largest had become 15 cm. tall, with finely developed frond.

The most recent discovery of the species, to my knowledge, was made by Mr. Ludlow Griscom, of the American Museum, in company with Mr. Mackenzie. Some scores of plants were found along an old wood-road, grown up with bushes, in the hills along the Delaware River below Dingmans, Sussex County, New Jersey, June 20, 1920. Mr. Mackenzie's material is of excellent specimens in prime condition, some approaching 30 cm in height—probably as handsome as has ever been collected in the state.

A fair distribution is thus outlined for what has been considered one of New Jersey's rarest fernworts: from the upland regions of northern New Jersey southward through the Middle District of the Coastal Plain into Salem County. Its occurrence further south is by no means improbable but a great number of upland types apparently reach their southern limit in the state in Salem County. Undoubtedly other intervening stations between Dingmans and Riddleton will continue to be discovered, and a greater frequence found in the northern counties.

One of the most interesting points, however, which these notes bring forth is the great diversity of habitats shown by the species—ranging from low, wet woods, or rich, rocky woods containing limestone outcrops to dry, sandy thickets. The differences are certainly more obvious than the similarities: in fact, it is difficult to find a point of similarity in the character of the various habitats except that of shade. As was discovered in the case of *Ophioglossum vulgatum* by the symposium in the AMERICAN FERN JOURNAL, this ally of the Adder's Tongue likewise not only tolerates, but flourishes under, the most varied conditions.

Botrychium dissectum with three fruiting panicles.

But when viewed from the standpoint of soil chemistry, possibly a correlation may be found in the apparent diversity of habitats. Dr. Edgar T. Wherry tells me that, in the case of two stations in Vermont which he was able to test, the soil in which the species grew gave a moderately acid reaction. He believes that the soil of the wooded slopes of the Delaware River would give a similar reaction, and suggests that even the Springdale station, near limestone cliffs, would probably be of an acid character from the humus in which the plant grows, while the Clementon locality would undoubtedly be acid—and probably of a high grade of acidity. It may thus at least be suggested that, until conclusive work has been done on the species along this line of research, *B. matricariaefolium* probably shows a preference for acid soils.

Academy of Natural Sciences of Philadelphia

Is Botrychium dissectum a Sterile Mutant?

The accompanying illustration of a plant of *Botrychium dissectum* bearing no less than three well-developed fruiting panicles would seem to answer the above question emphatically in the negative so far as sterility is concerned. Certainly, this individual is doing all that could reasonably be expected of it to avoid that condition. Normally, of course, the Botrychiums of the *tornatum* group fork once near the ground, one branch bearing a sterile and the other a fertile segment. In this case, the forking has been repeated higher up and a secondary fertile branch given off which has itself divided just above its base producing two secondary fruiting panicles somewhat smaller than the primary one. Such compound forms are occasionally found in *obliquum*; I have a specimen collected at South Windsor, Conn., by C. W. Vibert in which the branching exactly

matches that in the picture. A hasty and far from complete search in the literature at hand discloses two records of similar forms in *dissectum*, one reported by Mrs. Scoullar (Fern Bulletin **16**: 85), the other by Mr. Poyser (Fern Bulletin **17**: 68).

The specimen illustrated was found by Mr. C. C. Deam in Cass Co., Indiana, in Sept., 1921, among the colony of *dissectum* described by him in the last number of the Journal, and we are indebted to him for the photograph and for generously defraying the cost of the plate.

To return to the original question, my own experience strongly supports Prof. Hopkins's opinion (Fern Journal **11**: 114) that had Prof. Chamberlain extended his observations over a wider territory, he would have come to quite different conclusions. Indeed, I am confident that had he looked in any large herbarium he would have found plenty of specimens of *B. dissectum* with well developed sporangia full of spores quite as perfect in appearance as those of *obliquum*. In my own small collection, I have six sheets of fruiting *obliquum* and two of *dissectum*, the latter both of a type sufficiently extreme so that the question of identity raised by Prof. Hopkins does not concern them. If they are not *dissectum* there is no such thing. The size of the sporangia varies considerably, even on the same plant. The largest happen to be on a specimen of *obliquum*, but so are the smallest. Those of *dissectum* fall well within the limits of variation in *obliquum*. There are some shrunken and apparently abortive sporangia on one specimen of *dissectum;* but so there are on one of *obliquum*. *Dissectum* has numerous spores which, under the microscope, appear normal and viable, and are of the same size as those of *obliquum* and in no way different from them.

Among the hundreds of living plants I have seen in the field, I have never noticed any tendency to sterility in *dissectum*. To be sure, I was not looking for it, and one can overlook a good deal when one's mind is not bent on that particular thing. But it seems unlikely that any general tendency toward sterility in *dissectum* would have escaped the observation of the many botanists in the northeastern states who know it well in the field.

Mr. Deam has collected a series of small plants of *dissectum*, and in 1909 Prof. Schnaffner reported in the *Ohio Naturalist* (Vol. 10, p. 8) the finding of prothallia which were just putting forth their first tiny leaves; and these leaves showed the *dissectum* character. There is, of course, no absolute proof that these young plants sprang from spores, but it seems most probable that they did; and since at Mr. Deam's locality, a great deal of *dissectum* and only one plant of *obliquum* were found, the probability in that case becomes almost a certainty. I am quite ready to believe that *dissectum* is only a form of *obliquum;* I should not be surprised if the same plant were found to produce both types of leaves at different times, as happens in the case of the incised form of the Christmas fern. But I do not believe that *dissectum* is generally incapable of producing good spores.

In regard to the point made by Dr. Benedict (Fern Journal **11**: 54), that sterility is often associated with laciniate leaf-forms, it may be noted that the species he cites are not dimorphic like our Botrychium. Would laciniation of the leaf affect the fruiting segment in dimorphic forms? In the Christmas fern which is partially dimorphic, the incised form is commonly more heavily fruited than the typical form. In this species the incised form often, though not always, appears as a response to unfavorable conditions of growth, as when the soil is dried out by the cutting off of woods. Under such circumstances plants are likely to produce unusual

quantities of seeds or spores, as it were in a supreme effort to insure the perpetuation of the species. But the laciniate forms of cultivated ferns are rather associated with abundant food and excess of vegetative vigor—conditions which always tend to produce sterility. The analogy between *B. dissectum* and the incised form of the Christmas fern is not perfect—the former, for instance, never, so far as I know, shows any evidence of being a response to environment—but it is perhaps closer than the other.—C. A. W.

On a Supposed Hybrid in Equisetum.

C. A. WEATHERBY.

There are certain groups in our flora in which species, otherwise good and generally recognized as such, are connected by puzzling intermediate forms, sometimes in a very complicated manner. In recent years a good deal of work has been directed toward explaining these forms as hybrids of the species between which they fall. Much of this work is highly valuable: it furnishes, not only a reasonable and in several cases practically proved explanation of conditions as we find them, but a means of classification at once elastic and definite enough for all practical purposes. This is very good; but when, as occasionally happens, I find a plant not uncommon in a given region determined as a hybrid between two species, one or both of which are unknown there, I begin to feel that it is possible to have too much of this good thing—that maybe theories of hybridization offer rather too easy a means of disposing of puzzling forms.

The immediate occasion of this discourse is a recent experience of mine. In 1915 Miss Ruth Holden published a study of *Equisetum variegatum* var. *Jesupi*[1] in which, from the facts that its spores were apparently

[1] Holden, Ruth, The Anatomy of a hybrid Equisetum. Am. Journ. Bot. 2: 225–233, pls. 5–8. Aug., 1915.

abortive and its characters intermediate between those of typical *E. variegatum* and *E. hyemale*, she concluded it to be a hybrid of those two species. So far as I know, there is no reason to doubt the accuracy of Miss Holden's observations; her conclusions are persuasively and modestly stated; so far as the data given go, her article is convincing. But I recently had occasion to study and map in detail the New England ranges of *E. variegatum* and its variety *Jesupi*; and this work[2] brought out the remarkable fact that, although the general ranges of the two are, in northeastern North America, similar, they have apparently never been found growing together. The variety has been collected in quantity at Ft. Kent, Maine; the typical form is not known nearer than Ft. Fairfield, 50 miles away. The former is known from three stations in the Kennebec valley; the latter has never been found in that valley at all. Only the typical form has been found in northeastern Vermont; only the variety along the shores of Lake Champlain.[3] The points at which the two approach nearest are Salisbury and New Milford, Conn., 30 miles, and Royalton, Vt., and Summer's Falls, N. H., 20 miles apart. This evidence of the records can hardly be explained away as due to accidents of collecting. Both plants are rare enough in New England to attract attention wherever they occur and sufficiently different in appearance so that such keen and experienced collectors as Brainerd, Eggleston, Pringle, Fernald and the specialist in Equisetum, A.

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[2] This work, done as a member of a committee of the New England Botanical Club, was based primarily on the rich local collections of the Club and those of the Gray Herbarium; but the herbaria of the Boston Society of Natural History, of the Connecticut Botanical Society and of Yale University, several private collections, local floras where available and collectors' notes made specially for the purpose by members of the Club, were also consulted.

[3] Mrs. Flynn (Fl. Burlington 5. 1911) records the typical form from near Burlington; but Dr. Blake (Six Weeks' Botanizing in Vermont. Rhodora **15**: 156. 1913) could find nothing but the variety in that region and specimens very kindly sent me by Mrs. Flynn prove to be likewise referable to it.

A. Eaton, would not invariably have failed to get both if they had actually occurred together. And, to cap the climax, the second supposed parent, *E. hyemale*, var. *affine*, is unknown from northern Maine. One parent, then, is absent from all the stations for the putative hybrid, and both parents from one station, and that one of the best.

Such a situation raises puzzling questions. How can a plant be a hybrid when it is physically impossible that it should be so? That such a one as the Equisetum in point may be of remote hybrid origin cannot be certainly gainsaid; but, if so, its birth must have taken place very long ago. And a race of venerable age, which maintains itself, holds its characters and has become established outside the range of its nearest relatives, is at present a good species or variety, whatever its ultimate origin; to call it otherwise is simply to confuse definitions.[4] Nor can any theory of hybridity explain the consistent occurrence of our Equisetum in regions where one or both of its suspected parents are absent. Differences in soil preference might explain this; but, so far as we know, hybrids share the tastes of their parents in this respect.[5]

How, on the other hand, can a plant have all but the geographical ear-marks of a hybrid and not be one? Well, it often happens that sterling scientific hypotheses are given, by later scholars, a much wider application than their originators ever claimed for them.[6] We are wont to smile, nowadays, at the ingenious theories by which some evolutionists of a past generation tried to prove the serviceableness of certain characters to the plants or animals which possessed them. They as-

[4] See, on this point, Kerner von Marilaun, Nat. Hist. Plants (Oliver's translation) **2**: 588–590, quoted in Fernald, Science N. S. **54**: 73, July 22, 1921. For some requirements which a hybrid should fulfil, see Brainerd in Bull. Vt. Bot. Club **9**: 12, 13. April, 1914.

[5] See, for instance, Wherry, Am. Fern Journ. **10**: 52. June, 1920.

[6] Cf. C. C. Nutting in Science N. S. **53**: 128. Feb. 11, 1921.

sumed, more or less unconsciously, that every character of a living species must be of benefit to it. They forgot that natural selection would eliminate only those which were actually harmful; neutral ones, neither good nor bad, might, should they chance to arise in nature's multifarious experimenting, perfectly well survive. May it not be that, in the eager study of genetics since Mendel's law was rediscovered, we have gone too far—that we are, in the case in point, a little too ready to assume that every plant of intermediate characters must be a hybrid? This would seem to carry with it the further assumption that all variation in related stocks, when it occurs, must be in divergent directions. Yet it seems that, in species which are closely related and must, therefore have had a common progenitor in no very remote past and presumably possess ancestral tendencies in common, variation would be quite as likely (through reversion, if one likes) to proceed toward as away from types closely akin. It might conceivably produce forms outwardly indistinguishable from blend hybrids: only, they should breed true and the hybrids tend to break up.

It may be objected that such a theory does not account for the imperfect spores and pollen commonly found in putative hybrids. It does not. But, to the writer's mind at least, the significance of apparently abortive spores is not so certain as some of us suppose. One would like to see more germination experiments to see whether these imperfectly developed spores are as impotent as they look. Certainly, our Equisetum, existing, as it does, apart from its reputed parents must reproduce itself somehow. And "bad" spores, or pollen, are by no means always associated with other evidences of hybridity. Brainerd and Peitersen, in their work on New England Blackberries, found the pollen of *Rubus hispidus* to be 90% imperfect. Yet

that is one of the commonest and best marked of our species: no one has ever thought of suggesting it to be a hybrid and there is no pair of species in existence of which it could be the offspring. On the other hand, *Rubus frondisentis*, a plant of intermediate characters and regarded by Brainerd and Peitersen as a hybrid, has pollen 90% perfect.[7] And sterile mutants are by no means an unknown phenomenon.

In the case of *Rubus hispidus*, the ease with which vegetative reproduction can take place may have brought about partial sterility. In that of another suspected hybrid in Equisetum, *E. litorale*, Milde has advanced an interesting conjecture.[8] He thought this might be a worn-out and dying species and its infertility a sign of fading vitality and approaching extinction. However this may be, it seems plain that the last word on the subject has yet to be spoken.

These are the reflections of one far from adequately qualified to settle the problems involved. They are not meant to do that—only to emphasize the need of considering *all* the attendant facts in such cases as that here discussed if we are to have any well-rounded and convincing explanation of them.

EAST HARTFORD, CONN.

Reminiscences of a Fern Lover.

M. A. MARSHALL.

It has been suggested that stories of "first finds" may be an encouragement to new students of the ferns, as well as pleasant reminders to those long in the ranks. Several vivid memories occur to me.

As a preface it may be said that my first lessons in field botany and plant analysis were given me as a very

[7] Bull. Vt. Agric. Exp. Sta. **217**: 43. 63. 1920.

[8] Milde Monog. Equiset. 369. 1865.

young child holding the magnifying glass for my father, who was interested in every growing thing but had poor eyes. The old Wood's Class-book of Botany was always in an easily accessible place. In those days we thought analysis of ferns too difficult for the average student, but I learned the Osmundas and a few others by name and recognized without naming a good many common species. When later I went away to school I learned that fern analysis was not impossible after all, and in my teacher's herbarium saw, among other things, the "adder's-tongue fern," described as very rare and growing in such and such places and surroundings. For a long time I looked for it in every likely place I visited; then, one summer vacation, I was in the barn at my country home when the last load of hay was brought in —what in New England is called "meadow hay" or "swale hay," a mixture of fern, wild grasses, rush, etc. In the litter on the floor some fragments that looked like the sterile part of Ophioglossum caught my eye. I knew just where that hay came from; within a few minutes I was at the spot, and there, sure enough, in the deep pockets in sphagnum made by the horses' feet, was plenty of *Ophioglossum vulgatum*, and all about me the plants clipped by the scythe. The plant is growing there yet, some years abundantly, sometimes sparingly, but always there. I have since found it in two other places on the farm and several times in other localities.

An uncle of one of my girl friends had promised her and me to take us to a place where pitcher plants grew: he had come upon it while hunting. On July 4, 1884, the promise was fulfilled. We three, behind a staid old sorrel horse, took a wood road that wound back and forth but steadily upward until we came to a pair of bars that had been long disused, for they were securely nailed and built up to fend cattle. There our guide left us to cruise about a little—he knew we were near

the spot but the going was rough and he would find a good path for us. When we were at last led to the pitcher plant place we found the flowers long past their blooming time, but the spot was most interesting—a roundish, grassy place, perhaps half an acre in extent, surrounded by not very large forest growth, here and there upon it a red maple or a gray birch, a few sarracenias, a little *Cassandra calyculata*, as we called it then. Looked at from a neighboring cliff, as we later looked, it was like a little grassy bowl set in the green of trees. We did not dare venture upon it more than a few steps, it quaked so, and the owner of the bog told me afterward that twenty years earlier we could not have gone upon it at all—a ten-foot pole would not touch bottom. On the south border of this little bog was a fringe of large ferns that I knew were not Osmundas, but they were very impressive, rising against the trees and drooping over to touch the ground again. I could draw some of them up to my eyes, and I then measured five feet six and a quarter inches. They were just beginning to fruit and on getting some specimens home they were easily determined to be *Woodwardia virginica*. Later mature specimens were gathered, as they have been several times since.

Late on an August afternoon, some years after, my companion and the horse were left in the highway while I struck across a field at a venture, wanting some Woodwardia and knowing about where the bog lay. At the far side of the field I found a barway and a path leading into the woods and as I pressed through the thick carpet of ferns under my feet, I thought, "This doesn't look quite familiar." When Mr. Davenport's article on *Aspidium simulatum* appeared in the Fern Bulletin, I said, "That is the fern I saw over by the Whitcomb bog!" It was. It is there yet in great abundance.

Then there was the first finding of *Cystopteris bulbifera*. Taken on a pleasure drive in Hartland, Vermont, on the road between Windsor and South Woodstock, a growth of what appeared to be very graceful vines on the rocks and tree stems just where a little brook drops down off Pisgah into the wayside gutter, attracted my attention. Getting out to investigate, I picked a Cystopteris frond three feet long!

These are a few of the most vivid memories, pictures that will adorn my gallery and help to sweeten life as long as life lasts.

STILL RIVER, MASS.

Experiments in Naturalizing Ferns.

EDWARD H. CLARKSON.

During the past six years, the writer has transplanted several species of ferns to the woods around Newburyport and Rockport, Mass. In most cases these ferns have lived and flourished. The only disappointment was in the case of a little group of oak ferns, *Phegopteris Dryopteris*, set out on the bank of Jackman's ravine at the Newburyport water works. This grew well for several weeks after being put there and then was most unexpectedly destroyed, being covered by several hundred pounds of sand and gravel piled on it by a very careless woodchuck that dug a hole close by!

On June 1st, 1917, I transplanted from my fern garden to a certain rocky woodland valley on Scotland road, between Newburyport and Byfield, twelve male ferns, *Dryopteris Filix-mas*. Six of these were placed against a ledge in company with a number of thrifty marginal ferns, in a well-drained spot where there was plenty of overhead light and some direct sunshine. These have grown into large plants, which this year had many large fertile fronds. The six other male ferns, set out in the same

valley, but not near rocks and not in company with marginal ferns, have all lived, but have not done as well as the first lot.

A cluster of the maidenhair spleenwort, *Asplenium Trichomanes*, set out here in 1917, was placed in the crevice of a polypody-encrusted rock near the most flourishing colony of male ferns. This has not only lived, but seems to be increasing in size. A group of Goldie's fern, *D. Goldiana*, placed not far from here in 1917, has done well, putting out a fine lot of big fertile fronds this year.

Perhaps my most successful venture has been with the broad beech fern, *Phegopteris hexagonoptera*. Five colonies of this fern, which spreads rapidly by its branching rootstocks, were set out in various spots in partial shade, in 1916, 1917 and 1918. Before setting them out, the ground was thoroughly prepared by being dug up and all roots of plants and grass removed. At one place I added a lot of peat to the leaf mold and it is at this spot that the hexagonoptera fronds are largest and finest. All five colonies, however, have done well, producing numerous fertile fronds, and unless something unexpected happens to destroy them, should persist and spread.

Three lots of the narrow-leaf chain fern, *Woodwardia areolata*, were also transplanted to swamps around Newburyport and Rockport in 1916 and 1917. In every case these were placed not far from spots where the Massachusetts fern, *D. simulata*, was growing naturally, care being taken to select a well-drained piece of ground. All three of these groups have flourished and spread out to some extent, the Rockport colony in particular sending up this summer some of the finest fertile fronds I ever saw. This small chain fern is very rare in this section. Except for the little plantations just mentioned, I know of only two places where it may be found in Essex County. One is within half an hour's walk of

my home, at Ring's Island just across the Merrimack River, where there is a good-sized colony growing in a peaty swamp in company with many fine big Massachusetts ferns. The other is at Magnolia Swamp, Gloucester, Mass. In the northern end of this swamp there is a nice lot of this areolata. It also grows in numerous detached groups in a swampy spot near the "hermit's" cabin. I visited the hermit, M. A. Walton, who occupied this cabin for many years before he died, especially to see the two chain ferns—for the big chain fern, *W. virginica*, is also very abundant here, growing sometimes over five feet tall. Walton told me that when he first came here there was none of the little chain fern near his cabin. The following letter from him, explaining how this fern was transplanted to the swamp nearby, is very interesting. The fern book that he speaks of was a copy of Waters' "Ferns" that I gave him.

Gloucester, Aug. 22, 1916

My dear Mr. Clarkson:—

Fern book was received yesterday. It is a delightful book. Please accept my sincere thanks for same.

Now as to ferns. When I came here 32 years ago I found the chain fern (Woodwardia angustifolia) in Magnolia Swamp, but in the north end only. The park owns that location, with the exception of lots that I control (subject to sale). Students came to my cabin hunting for ferns to press. Many were from colleges. I was told that it would be a good plan to transplant the fern to the swamp near the cabin. I took the hint and transplanted twenty lots to the swamp where you got the ferns when here. The swamp contained no chain ferns before. Now there is a fair number scattered over the swamp. The swamp is owned by the park and the park will not allow anything to be removed. The park may buy the lots under my care; in that case it would have all the chain ferns. I have tramped over about every foot of swamp in Gloucester and Magnolia and not a frond came to hand. The late Charles Pew told me that twenty years' walks of the Gloucester Nature Club had failed to find the fern except in Magnolia Swamp. It would be time wasted, I think, to hunt swamps.

Sincerely yours,

M. A. Walton.

In the woods near the Artichoke River, in West Newbury, is a fine colony of the maidenhair fern, *Adiantum pedatum*, that was undoubtedly put there many years ago by a lady who lived not far away.

If other members of the American Fern Society would also try the experiment of setting out some of the less common ferns in the woods near their homes, it might prove not only very interesting, but possibly might bring very practical results. The male fern, for instance, might be induced to live and propagate so that eventually it would be more widely distributed.

NEWBURYPORT, MASS.

CYSTOPERIS BULBIFERA BERNH. Our President, Mr. Wm. R. Maxon, has outlined in the May–June Fern Journal some valuable suggestions to fern lovers along the line that each member should give special and accurate study to some particular fern in his locality, with reference to its life history in every detail from season to season, and report any interesting information thus acquired for the benefit of our fellow fern fanciers.

There is in this vicinity a fairly deep ravine containing a running stream, the upper sloping banks of which are shaded mostly with maple, birch and spruce foliage. The illumination from above is sufficient for a rich, healthy growth; the sub-soil is ordinary, grayish clay, overlaid with quite a depth of leafy black mould in which are creamy, granulated, and graduated particles or lumps of carbonate of lime, from the size roughly speaking of rice to that of lump sugar and larger. The middle of the bank is fairly level and dryish but the balance of the incline is quite steep and moist, while through the top of the loam there is a constant seepage of moisture from above, making the soil in most places quite soft and boggy and too wet to tread upon with comfort.

The extent of the area under consideration is, I should say, not more than seventy-five by three hundred feet, On it grows, undisturbed (excepting by myself), a luxuriant and splendid stand of *Cystoperis bulbifera* Bernh.

One day six years ago, I stumbled upon this locality and to my intense delight found many beautiful variant forms of this interesting fern, cu led and coiled in very many shapes, star-shaped, forked, right-angled, oval, twisted, one-sided, branched, and one specimen eleven inches broad at the base with only six pair of pinnae; and other feathery forms in beautiful and interesting contorted shapes.

The peculiar feature of this station is, that one can go year after year with the assurance that similar variant forms will reward one's search; while elsewhere for miles around it is most unusual to find a freaky or forked specimen.

Perhaps ninety per cent. of the variant forms are of a deeper shade of green than the type; and can readily be detected in this pretty fern bed by the color test alone.

Three years ago I removed one dozen of the handsomer forms of these plants to my home fern garden in the month of June, hoping to see an even greater improvement by transplanting. In this, I was doomed to disappointment; every plant grew splendidly, sending out many healthy new fronds but each returned to their original type variety. For three years these plants have been carefully cultivated and cared for with the result that there have been but three or four forked pinnae to reward my experiment. I have tried to spell it out and have failed unless the seepage of possibly cold spring water, charged so heavily with lime carbonate, chills the plant roots, influencing the growing fern to turn, squirm and twist under the cold root bath.

W. R. MCCOLL, OWEN SOUND, ONTARIO.

LYCOPODIUM COMPLANATUM, VAR. FLABELLIFORME WITH TWENTY-FIVE SPIKES. On page 119, vol. 9, of the American Fern Journal, October–December, 1919, Prof. Jennings notes finding in the herbarium at the Carnegie Museum a specimen of *Lycopodium complanatum*, var. *flabelliforme* with seven spikes. The year 1919 was, in my region, very fruitful among the Lycopodiums. All through the season I noted every carpet of the plant thick set with its candles. When it came time to gather the Christmas greens, I found many interesting specimens. One fruiting branch had its normal two peduncles but the two were so divided and subdivided as to have in all twenty-five spikes, if a branch of one spike is to be counted as a spike. Another fruiting branch had its two peduncles, each with more than the normal number of spikes; but the central bud that should have produced the next year's growth, had developed like a continuation of the plant's main stem, was nearly a foot long and had rootlets.—M. A. MARSHALL, STILL RIVER, MASS.

American Fern Society

REPORT OF THE PRESIDENT FOR 1921.

The year 1921 was in several respects one of unusual interest and importance in the history of the American Fern Society, especially in membership increase, in the consideration of plans for greater future usefulness, and in the pleasure members derived from the impromptu meeting held in connection with the Fern Exhibition of the Massachusetts Horticultural Society at Boston in September. At this meeting there crystallized a feeling that had been entertained by several members quite independently that in view of the steadily increasing use of ferns as house plants it would be well

worth while to devote attention to the horticultural phases of fern study. From this developed the idea of stimulating the greenhouse cultivation of tropical ferns. These, most of us will agree, are quite as interesting as orchids, to which group so much attention has long been given, and are possessed of a charm and inherent beauty of grace lacking in most flowering plants. As a matter of fact, ferns and orchids grown together in the greenhouse are truly complementary, a fact very well known to growers and thoroughly appreciated by those who viewed the beautiful exhibits at Boston. The cultivation of tropical ferns is probably, on the whole, not more difficult than that of tropical orchids, and it ought to be carried on generally by private growers as a parallel activity. Hundreds of tropical ferns are cultivated in British conservatories and are well known in their "trade," but only a fraction of these are grown in America. Besides these there are as many more kinds, equal or often superior, and readily available for introduction from the American tropics, which have never been brought under cultivation here or elsewhere, even in the larger botanical gardens. Once the unique beauty of these is partially appreciated their introduction is bound to follow. To make known their distinctive characters and excellence, with a view to their culture, is an entirely legitimate field for the Fern Society. In this there is no danger of infringing upon our original interest in the ferns of temperate North America, any more than the cultivation of selected varieties of *Fuchsia* and *Begonia* can be said to destroy a love of botanizing or an appreciation of one's local flora; and it was the consensus of opinion of members present at the Boston meeting that from now on greater attention ought to be given to exotic ferns, whether as house or conservatory plants.

The welcome increase in membership—now for the

first time above the 300 mark—will afford an opportunity of publishing more pages and more illustrations in the JOURNAL, to the Editors of which the Society is under renewed obligation for their painstaking and excellent editorial work. Of the new members the great majority are situated in New York and the New England states. More are needed from the South and West. If the exchange of specimens is as lively as it was 25 years ago, new members in the latter regions will be kept busy responding to the requests of their eastern fellow-members. Perhaps if only in self-protection they will become imbued with a missionary spirit that will bring in new members from their own regions!

To all new members the Society extends a word of cordial greeting: Make this society your own in every way, for it *is* your society just as much as it is that of members of many years seniority. Develop correspondence with distant members, you will find that you belong to a sort of guild, and that your fellow-members will willingly give assistance in every way. Contribute notes, short articles, and queries to the JOURNAL; these are more useful than most other kinds of contributions, and are certainly more stimulating to the membership as a whole than are strictly technical articles. The new list of members recently published as a supplement to the JOURNAL, will be found very useful to members both new and old. The extremely low cost of publishing this list was made possible through the generosity of Mr. R. A. Ware. To him and the other members of the special committee on membership, Mrs. Carlotta C. Hall and Professor Winslow, are tendered the sincere thanks of the Society. Thanks are also due Professor Winslow and Miss Marshall for their continued and very successful efforts in disposing of back sets of the JOURNAL.

Publication of the presidential report for 1920 was, unfortunately, so much delayed that the suggestions for field study by members could not possibly be followed out last year. They are therefore urged for the season of 1922. A number of letters agreeing wholly as to the profit to be derived from intensive study of our familiar species have been received, and it is evident that the plan is regarded favorably. The points raised are as true now as when written. If the plan of studying the *Dryopteris* species is successful, other groups can be taken up in succeeding years. It is worth trying.

With thanks for the continued support of the members, and the hope that the present year may prove thoroughly successful,

Respectfully,
WILLIAM R. MAXON, *President.*

Report of the Secretary for 1921

Except for the Boston meeting, already reported elsewhere, there have been no special meetings by the Society during the past year.

Four members have died: Miss Mary L. Anderson, Stewardson Brown, Charles Noyes Forbes and Mrs. Emily Hitchcock Terry. Nine members have resigned. Forty-three new members have been received and the membership (December 31, 1921) stands at 301, a gain of thirty over last year. This establishes a new record for the Society; which is very gratifying, showing that it continues to enjoy the support of its members, and that the raising of the membership fee from one dollar to one dollar and fifty cents during 1921 has been in no way detrimental. It is hoped that such generous support may continue. A new and revised list of the members of the Society was prepared and issued as

a Supplement to the American Fern Journal, Vol. 11, No. 3.

The following gifts to the Society collections have been received:—Carl Christensen has contributed pamphlets on the ferns of Madagascar, Easter Island, and Juan Fernandez; also Part II of "A Monograph of the Genus Dryopteris" and other separates. William R. Maxon also sent in some old Fern Society annual reports.

S. H. BURNHAM, *Secretary.*

Because of the great delay in issuing the JOURNAL and consequently in getting in the bills for the year, the Treasurer was unable to prepare his report in time to appear in this number. It will be printed in the next number.

Report of the Editors for 1921

During most of the year the editors have been thankful if the JOURNAL was issued at all, even if long past the appointed time. On May 1, 1921, the establishment which does our printing was completely tied up by a strike. The spring number of the JOURNAL, the make-up of which was ready and in the printers' hands on that date, finally appeared on October 12th. The summer number was correspondingly delayed; but we gained a little on No. 4 and, though the trouble is not yet over, we hope, given copy enough well in advance, to be back on schedule time before the year is out.

Beginning with number 4 of volume 11, we shall, barring unforeseen emergencies, have at least one illustration in each number. Several desirable pictures are now at hand and more are to come. Further prospects for the coming volume include an account of a plant and bird sanctuary actually in operation and

one or two articles on cultivated ferns, a line in which we hope to do more than in the past.

During the year there have been several additions to the list of libraries and institutions subscribing for the JOURNAL and, thanks to the efforts of our Vice-President and to the membership drive, the sale of back numbers has continued active. Only seven complete sets now remain in stock.

The Society includes members of many kinds from professional botanists to amateurs of comparatively little technical knowledge and beginners of almost none. They naturally regard fern study from different angles. So far as its necessary limitations permit, the JOURNAL aims, and exists, to serve the needs of all. It is not to be expected that everything in every number will be of equal interest to all; but it is hoped that every member will find in each number something of interest to him.

The Editors tender their heartiest thanks for the gifts for illustration received and for the interest shown and the support offered by members in other ways.

R. C. BENEDICT
E. J. WINSLOW
C. A. WEATHERBY
Editors.

Report of the Curator for 1921

Since the last Report of the Curator several important additions have been made to the Society Herbarium. Prof. J. C. Nelson of Salem, Ore. contributed specimens of *E. Telmateia* (dimorphic), *fluviatile* and *fluviatile polystachyum*; also some mounted specimens collected in Ontario by W. R. McColl. Mr. D. Leroy Topping has made important additional contributions from the Philippines and eastern Asia. Miss Elmira E. Noyes

of Portsmouth, Va., contributed a splendid set of ferns collected mainly in Virginia. Dr. C. E. Waters of the Bureau of Standards has presented the Society with his entire collection of Pteridophytes running well above 1500 sheets. These donations will increase the number of mounted sheets in the Society Herberium by two thousand or more and will bring the total number of sheets up to about six thousand. In behalf of the Society the Curator wishes to thank those who have made the contributions just named

L. S. HOPKINS, *Curator.*

Report of the Judge of Elections for 1921

As Judge of Elections of the American Fern Society, I make the following report of the Election of Officers held in October 1921.

For President	*For Vice-President*
Wm. R. Maxon..... 85	Miss M. A. Marshall,..... 85
Washington, D. C.	Still River, Mass.
For Secretary	*For Treasurer*
Stewart H. Burnham..... 85	Jay G. Underwood, ... 85
Ithaca, N. Y.	Hartland, Vt.

The number of ballots cast was 85. I therefore declare the above persons elected.

Respectfully submitted,

CHARLES C. PLITT, *Judge of Elections.*

Miss Agnes W. Lincoln, a member of the American Fern Society since 1902, died at the New England Hospital for Women and Children in Roxbury on December 27, 1921. Miss Lincoln was born in Medford, Mass., July 16, 1856, the daughter of Algernon Sydney Lincoln and Abby Bigelow Stone. She began her education in the public schools of Medford, later attended a private school in Boston, and to the time of her death devoted

a portion of each year to special courses of study first at Radcliffe College and later at the Boston University. She was an early member of the Appalachian Mountain Club, a member also of the Massachusetts Horticultural Society and, in connection with her interest in antiquities joined the Massachusetts Historic Genealogical Society, the Medford Historical Society, and was for years corresponding secretary of the Stone Family Association. She had visited Europe several times, seen the sun rise from the rim of the crater of Kilawea in Hawaii and camped in the Canadian Rockies. She was always enthusiastic for the out of doors, fearless, sympathetic, thoroughly democratic, and childlike with all. Her home has always been in Medford.

Through the kindness of Mr. Maxon the editors have received an obituary notice of Dr. Hieronymus of Berlin. Though rather a general taxonomist than a specialist in ferns, he had, probably, done more work on the pteridophytes than on any other group, and that work has added so much to our knowledge of the species of tropical and, in some cases, temperate America that it deserves more than a passing notice in our JOURNAL.

Georg Hieronymus was born at Schöneiche near Neumarkt in Silesia, Feb. 15, 1846 He was at first educated for a physician, but soon abandoned that profession for the study of botany. In 1873 he went to Cordoba in Argentina as a professor in the university there, a position which he held until 1883. In that year he returned to Germany, settling at Breslau and devoting himself to independent botanical research, especially on the algae of Silesia. He also contributed the treatment of several groups of flowering plants to Engler and Prantl's great work on the families of plants.

In 1892 he was offered and accepted a curatorship at the Berlin Botanical Museum, where he served until

shortly before his death. Here one of his chief tasks—or one which he chose for himself—was the organization of the Museum's extensive collection of ferns and fern allies. From this work resulted his many studies of fern floras of certain regions and of groups of pteridophytes, studies which have cleared up many problems of classification. To Americans, he is probably best known for his work on the genus Selaginella, especially in the group of *S. rupestris*.

He was for 28 years editor of *Hedwigia*, one of the foremost journals of cryptogamic botany. He died at Berlin Jan. 18, 1921, after a long illness.

One more correction in the recently issued list of members is called for. Harold V. M. Halsey should be Harold V. W. Halsey.

New members:—

Mansfield, William, Dean of the Albany College of Pharmacy, Albany, N. Y.
Tilton, Rev. George H., 470 Lebanon St., Melrose, Mass.
Upham, Miss Ethel E., East Woodstock, Conn.

Through a misunderstanding on the part of the editor responsible for the make-up of the JOURNAL, no mention was made in the last number of the fact that the plate of the climbing fern which appeared in it was contributed by Mrs. E. G. Britton. The editor at fault wishes to apologize to Mrs. Britton and to assure her of our gratitude for her generous gift.—C. A. W.

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A QUARTERLY DEVOTED TO FERNS

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EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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American Fern Journal

Vol. 12 APRIL–JUNE 1922 No. 2

Game Laws for Ferns and Wild Flowers.

R. C. BENEDICT

During the year 1921, the state of Vermont passed a law for the protection of native wild plants, specifying some twenty odd species of flowering plants and several of ferns. (See list appended at end of article.) The law provides, among other things, that these plants may not be collected for commercial exploitation and that a botanist may collect no more than two specimens of any plant on the list in a given season. The particular ferns listed are all among the less common sorts, mostly rare alpine species. Here is a first general "game law" for plants. It is worth some detailed consideration. What is the present need for such a law, in Vermont, and in other states? It will be worth while to consider the topic in a broad way, covering not only the Vermont situation but also the whole matter of wild plant conservation in general. It is hoped that this general consideration may call forth the expression of observations and opinions from as many viewpoints as possible; that the rather general outlines here presented may be filled in accurately.

In May, 1921, the Massachusetts Horticultural Society held an exhibition in Boston of native wild orchids. The exhibition as set up occupied one large room in Horticultural Hall, and was presented by the president of the Society, Mr. Albert C. Burrage. For the

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occasion the room was transformed into a similitude of a New Hampshire corner, with a bit of lake in the center, surrounded by a lush growth of the showy lady slipper, perhaps one hundred and fifty individuals, and other attractive wild plants, including about twenty-five different wild orchids. These had mostly been dug up the preceding season, held over winter, and forced into flower in greenhouses. At first scheduled as a four day exhibit, the interest it aroused caused a week's extension. Twenty-two thousand people were recorded as visitors. At a similar exhibition held this spring, over seventy thousand attended. Think, estimate if you can, the effects of thus presenting nature in its sheerest loveliness to so great a multitude of people. We of the Fern Society number a bare three hundred of nature lovers, meeting in the pages of the Fern Journal to share our common interests, and, in twos and threes, meeting in actual visits to the haunts of the ferns we study. What are we doing to promote the wider knowledge and understanding of native ferns? To pass on to others, to convert others to the same understanding and love of outdoors? Surely, if so many thousand people cared to visit these two exhibitions of native flowering plants set up in the manner of outdoors inside a brick building, we fern lovers of the whole broad continent of America, with the wealth of mountain, forest, glade and glen, canyon, meadow, stream, pasture, even desert, from Alaska and Greenland to the jungles of Panama, we have something to contribute that multitudes need and want; not merely one wild corner from one state, but innumerable vistas of beauty, the remembrance of which thrills and tingles.

"There are few things so broad as a 'narrow specialty' if you will follow it down to the ends of its wide-spreading roots!"[1]

---

[1] Edward S. Nichols, in an address at the laying of the cornerstone of the chemical laboratory of Cornell University.

What do particular fern species recall to you? I see a leaf of hart's tongue and am transported to central New York, to the glacial lake basins, the fossil waterfalls, near Jamesville, back twenty years to my first find of this fern as a boy. I see limestone cliffs, blue-green water; white cedar thickets which had to be broken through and which I can feel vividly. I see a leaf of the mountain *dilatata*, and climb again Blue Mountain in the Adirondacks, to a view of sixty lakes, to a bed on balsam. The royal fern means lakes and streams: Onondaga, of Indian legend, with black mucky woodlands, mosquitoes, the royal fern six feet high; or I am driving a light guide boat through an Adirondack lake and meander, rowing past bright yellow patches of this fern in a heath background of September, to carries over which the boat, oars and pack must be toted various distances. Goldie's fern calls back rich woodlands, open sunlit undergrowth with the glint of spotted light and shade, parked stretches of great beeches and birches, with silver and golden bark. With Goldie's fern usually were found two or three other species, not to be had in every woodland, the silvery spleenwort, the narrow spleenwort, and sometimes, nearby, the dainty oakfern.

The Massachusetts fern, first seen within the city limits of Greater New York, carries also a much more attractive association of memories: around Quiver Pond in the Adirondacks, along an old abandoned corduroy road of former lumbering operations, leading to a cached canoe hidden by a beaver dam. Here was trout fishing along a section of Third Lake Creek from which the engineering operations of the beaver had barred wading or fishing from the banks. Here, again, was the thrill of unexpected turnings, of alder-choked stretches barely wide enough for the canoe, of surprised beaver, not to forget the trout caught and the ones that got away.

"Goldie's Fern calls back rich woodlands"

For many, Goldie's fern, Braun's holly fern, the fragrant shield fern and others must recall Smugglers' Notch in the Green Mountains of Vermont, with all the lure which mountains offer; but Smugglers' Notch must lack a particular charm if Goldie's fern is gone, just as New England pastures lose luster when the laurel is stripped from them to decorate some private backyard, no matter how large and glorified. They tell us that these ferns are no more there, that Smugglers' Notch has been despoiled of these and other rare plants. So, for the state at large, we have as a result the 1921 conservation law. In time, Goldie's fern, the wall rue, the Woodsias, Calypso, the ram's head lady slipper, and the rest should come back again, but in the meantime, will not the beauty spots of other states lose some of their choicest gems? What can be done?

The problem involves a consideration of the various circumstances and industries which threaten the existence of our rarer wild ferns. We shall find some of these dangers partly unavoidable but others with some possibility of amelioration.

The depletion of the Vermont flora seems mainly to have been due to the activities of collectors for firms which make a business of selling live plants. Many of us have had their catalogues and may have ordered a few plants of species not available in our own immediate neighborhood, without realizing the consequences. The case for this industry is thus stated in a letter from one of the best known dealers in wild plants and one who has been held largely responsible for the extinction of Goldie's fern at Smugglers' Notch: "It is true that for thirty years, up to within the past few years, I have been gathering material from Smugglers' Notch. I have not, however, in all that time taken over two hundred *Aspidium Goldianum* and a larger number of *Aspidium Braunii*. During all my years of collecting

there I have never before had my right questioned to take them: in fact this territory up to within a comparatively short time has been owned by private individuals who have given me the right to gather these things. During my collecting it has not been my intention to exterminate or deplete materially any of these rare things but just now there seems to be an agitation which is pointing me out as a robber of the woods. I will ask you as a fair minded person and one undoubtedly familiar with native plants whether the work I have been doing has not added more to the enjoyment of the many, than to have left these ferns where they were naturally growing to be killed out by natural causes and by vandalism. These two varieties I have sent to all sections of the United States and many of the purchasers I think now have them growing on their own grounds, and many of these could not have enjoyed them had they been obliged to go to their natural habitat.

"I am not offering this as an excuse for what I have done, yet I think there are two sides to this question; furthermore, I have distributed spores of these rare ferns in a great many places where I have been and undoubtedly many of them have germinated and in years to come many more ferns will be found.

"I assure you I am very much interested in protecting our native flowers in general. Personally I have taken very few of these plants from the woods but have depended on those who are established in the *business of collecting in various sections of the country*. While legislation can do very much to prevent the taking of rare varieties I think it can never stop the gathering of native material as people who are interested in wild flowers are bound to get out into the woods and gather them for themselves. I think the real way to protect our native flora is to interest people so that they will

start wild flower gardens of their own." . . . .

"It is true that I have grown ferns from spores and have grown the two varieties you have mentioned, yet *it is impossible to grow* all these ferns *in sufficient quantity to supply the demand.*"[2]

Replying to the above letter, the following comments were made: "I can readily see that the idea of bringing the woods to peoples' backyards by serving to distribute various kinds of ferns and wild flowers not easily accessible would appeal to one interested in wild plants and and in gardens also. But I am sure you will also see that if, despite your conservative collecting, ferns formerly abundant, as *Dryopteris Goldiana* at Smugglers' Notch, have been practically exterminated there, the possible good of distributing such plants has been more than counterbalanced by their destruction in natural surroundings. If you succeed in further stimulating the growing of wild ferns, say specifically *Goldiana*, in backyards, etc., it will not be long before the wild supply will have been entirely exhausted. And what is true for one species is of course true for others also." Parenthetically, let me interpolate the further comment that the mortality of the Goldie and other ferns and wild flowers will be extremely high in the average home garden.

It seems to me that we may reach certain general conclusions with respect to the sale of wild ferns and flowering plants.

1. There will always be some kinds so common, so plentifully reproduced, that nature may be depended upon to supply any probable commercial demand.

2. There will be others, less common, like *Goldiana*, which cannot stand commercial distribution, although they would be able to keep pace with less extensive

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[2] Italics in this letter by the editors.

collection by private individuals for their own gardens. It seems to me that the sale of such species should be restricted to artificially raised plants, not at all a difficult problem.

3. There are still other ferns, like native hart's tongue, the rarer woodsias, the climbing fern, and various orchids, et al., whose sale should perhaps be prohibited altogether, unless their artificial cultivation and reproduction is demonstrated to be easily feasible. In other words, rarer ferns and flowering plants need to be treated as are the birds which are divided into protected and unprotected lists. Horticultural societies would do well to encourage the exhibition of artificially raised examples of interesting wild plants. Lovers of wild plants in various states should ask their respective legislatures to follow the example of Vermont in establishing protected lists of plants, the sale of which should be restricted to supplies artificially propagated.

Aside from commercial collection, other dangers threaten our wild fern flora. A year ago, April 7, 1921, President Harding issued a proclamation including the following statements: "The destruction by forest fires in the United States involves an annual loss of approximately $200,000,000 and the devastation of approximately 12,500,000 acres of timberland and other natural resources, and the present deplorably large area of non-productive land is being greatly increased by 33,000 or more forest fires which occur each year, ..." The conservation of forest loving ferns is thus indicated as included in the general forest conservation problem.

Mr. Weatherby has pointed out that in the Hartford section the climbing fern is partial to soils and situations very well suited for the culture of tobacco, and the best stands of *Lygodium* are even now being destroyed. Similarly, with the gradual drainage of large swamps for

agriculture, the homes of such ferns as *Woodwardia*, and of many choice orchids will be requisitioned.

The threatened destruction of the hart's tongue near Jamesville, N. Y., by quarrying interests illustrates another danger. To some extent, the hart's tongue situation has been helped by the establishment of the Clarke reservation around West Green Lake, including as it does, several plots of ground where this fern is fairly abundant. But parks of this sort carry their own danger, for with the influx of larger and larger numbers of people, the danger to rare plants is obvious.

A not inconsiderable danger threatening rare plants is due to people who should be the first to guard against the destruction of any plant habitat. I refer to the collecting botanist who either thoughtlessly or selfishly, in order to fill his collections, does not hesitate to take the last growing plant of some rare species. An interesting example of this occurred in Syracuse some twenty-five years ago. Within the city limits, a small sphagnum swamp had formerly been the habitat for arbutus, the ram's head lady slipper, and others. An attempt was made to reestablish arbutus by transplantation from another locality, but within a year an enthusiastic local collector, brought the transplanted arbutus as an herbarium specimen to the man who had re-introduced it.

The above outline of the different agencies causing the destruction of rare wild plants carries in general for each danger the possibilities of protective action. Against the invasion by agricultural and quarrying interests, there are apparently only two practicable means: first, it would be worth while to work for the establishment of reservations of selected regions noteworthy for their rare plants. If such regions can be made extensive enough to include a wide range of park land, there will be less danger from the invasion of the

uninformed than if the reservation is more limited. The Clarke Reservation west of Jamesville is a case in point; other localities should have been included. A special type of reservation is probably desirable, along the lines of the bird sanctuaries, which are being established in different parts of the country and to which reference has already been made in an earlier Fern Journal by Mrs. Britton. Such sanctuaries, of limited area, could well be maintained by local communities, with constant protection, as part of their educational facilities. A sanctuary of this type at Fairfield, Conn., is an excellent case in point. The only other means of preventing the destruction or depletion of rare plants when threatened by agricultural, quarrying, or lumber interests, would seem to lie in the transplantation of such rare plants to other favorable localities in less danger of invasion.

With reference again to the commercial collection and sale of living plants, the suggestion is repeated that some such list of protected plants as is represented in the case of the Vermont law, should be drawn up for each state. The list, of course, would not be the same throughout the country. Nature societies locally interested should be the activating agencies in securing the passage of such laws. In general I believe the practice will also be to a considerable extent self-corrective in the fact that the continued exploitation of a rare species will eventually reduce the available stock to such an extent that it will not be practicable to market. Before this happens, however, it is to be hoped that the commercial collectors, who undoubtedly generally have as keen an interest in plants as amateur or professional botanists, will see the matter from the standpoint of the future. In the case of ferns, there does not seem to be any reason why the most decorative species cannot be grown in commercial quantity artificially. Our native hart's tongue, Goldie's fern, and most of the

others which do not require extreme heat all winter, may be readily raised from spores under economic greenhouse conditions.

In the preceding case as in the case of amateur and professional botanists, or the plant lover who merely collects a few plants for the home garden, the strongest appeal should lie in the basic interest of all these types of people in plants themselves. It is probable that the collection even of some of the relatively uncommon ferns like the Goldie Fern by private individuals in sufficient numbers for their own gardens will never seriously endanger the supply; it is only when some wealthy individual establishing a private estate orders single species of ferns by the thousand. It is difficult to see just what practical measures can be taken against the individual botanical collector who collects so extensive a set of specimens of any given plant that its existence in a given locality is threatened.

Certain evergreen species of ferns have furnished the basis for another industry of considerable importance, i. e., the collection of their leaves to use with bouquets of flowers, already very adequately discussed in the Fern Journal by Mr. Burnham (vol. 9, pp. 88-93). Three of our common species seem to be involved, the so-called fancy fern (*Dryopteris intermedia*), the Christmas fern, or to give it its trade name, the dagger fern (*Polystichum acrostichoides*) and to a lesser extent the evergreen or marginal shield fern (*Dryopteris marginalis*). The question involved with respect to this industry in relation to the possible depletion of the native supply of these ferns is apparently satisfactorily answered. Although the numbers of these ferns collected and sold in Boston and New York and other cities has increased enormously in the last twenty years, the price has not increased at all, an apparent certain indication that the supply is still ample. I am informed also that the methods of

collection involve care which probably does relatively little injury to the plants. A collector for example must break off the leaves carefully. Careless pulling would involve uprooting the stem which would make necessary the later trimming of the leaf bases. An additional point with respect to the Christmas fern depends on the fact that the fruiting leaves with their dimorphic tips are in general undesirable, so for this species at least the fruiting leaves are almost invariably left on the plant. For the other two species, it is a fact that in general, their spores are mature long before the collecting period, which falls largely in August or September. Thus the reproducing of new plants is amply provided for before the leaves are taken off. Not all the spores have been dropped however as may be realized when these leaves are used in table decoration. Laid flat on the table, they will very often leave a rather ample spore print on the white cloth.

Another item in connection with this industry is found in the fact that at least one source of supply is being discovered in Florida. Mr. Fred W. Fletcher, formerly of Auburndale, Mass., has transferred at least part of his activities to a Florida plantation, where he raises the leather fern (*Polystichum adiantiforme*) for shipment for this purpose.

Will not other fern lovers contribute from their experiences any facts of interest relating to particular species deserving protection in their localities, observations as to the decrease or increase of any kinds, the possibility of establishing new colonies, movements looking toward the establishment of sanctuaries, the passage of protective laws? The conservation of the wild is receiving a great deal of general attention at this time, so that any local action will receive the help that goes with concerted action. The Vermont law is reprinted here as a matter of record and as a suggestion for action in other states.

NO. 260. AN ACT TO PROTECT RARE PLANTS AND TO PROTECT THESE PLANTS FROM BEING SOLD FOR COMMERCIAL PURPOSES.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. A person shall not take in any one year, except upon lands owned or occupied by him, more than a single uprooted specimen or two cuttings of each of the following plants, and then for scientific purposes only: fragrant fern, Aspidium fragrans Sw.; Goldie's fern, Aspidium Goldianum Hook.; mountain shield fern, Aspidium spinulosum Sw., var. dilatatum Gray; green spleenwort, Asplenium viride Huds.; wall-rue spleenwort, Asplenium Ruta-muraria L.; slender cliff brake, Pellaea gracilis Hook.; Braun's holly fern, Polystichum Braunii Fée; alpine woodsia, Woodsia alpina S. F. Gray; smooth woodsia, Woodsia glabella R. Br.; club moss, Lycopodium annotinum L., var. pungens Desv.; fir club moss, Lycopodium Selago L.; jack pine or gray pine, Pinus Banksiana Lamb.; calypso, Calypso borealis Salisb.; ram's-head lady's-slipper, Cypripedium arietinum R. Br.; green alder, Alnus viridis DC.; alpine willow, Salix phylicifolia L.; alpine willow, Salix uva-ursi Pursh; yellow mountain saxifrage, Saxifraga aizoides L.; alpine saxifrage, Saxifraga Aizoon Jacq.; mountain saxifrage, Saxifraga oppositifolia L.; Greenland sandwort, Arenaria groenlandica Retz.; vernal sandwort, Arenaria verna L., var. propinqua Fernald; northern comandra, Comandra livida Richards.; Lapland diapensia, Diapensia lapponica L.; hoary or twisted whitlow grass, Draba incana L.; black crowberry, Empetrum nigrum L.; northern gentian, Gentiana Amarella L., var acuta Herder; hedysarum, Hedysarum boreale Nutt.; butterwort, Pinguicula vulgaris L.; alpine mountain ash, Pyrus sambucifolia C. & S.; three-toothed cinquefoil, Potentilla tridentata Ait.; mountain shadbush, Amelanchier Bartramiana Roem.; few-flowered cranberry tree, Viburnum pauciflorum Raf.; pale painted cup, Castilleja pallida L.; lesser wintergreen, Pyrola minor L.; dwarf Canadian primrose, Primula mistassinica Michx.; dwarf bilberry, Vaccinium caespitosum Michx.; bog bilberry, Vaccinium uliginosum L.; cow berry, Vaccinium Vitis-idaea L.; mountain astragalus, Astragalus Blakei, Egglest.; large-leaved goldenrod, Solidago macrophylla Pursh; alpine goldenrod, Solidago virgaurea L.

Section 2. A person who violates the provisions of this act may be fined not more than ten dollars for each plant or additional cuttings so taken.

Approved April 1, 1921.

BROOKLYN BOTANIC GARDEN.

A Fern Collecting Trip in Cuba

E. W. GRAVES

For a number of years it had been my great desire to make a trip to the tropics, and see for myself some of the beauties of tropical verdure. Not until the fall of 1919 was this privilege given me. Two years before I had tried for a passport, but as the war was on, and as all ablebodied men were needed at home, it was refused me. But in October, 1919, I succeeded in getting Lansing's signature to the necessary papers.

Early on the morning of the 26th I left Mobile on the L. &. N. for Jacksonville, Florida. All day long we traveled over the sandy stretches of the Gulf slope, now and then running through scattered pine forests. Often near streams we would see groves of live oaks festooned with Florida moss hanging from the limbs. Reaching Jacksonville about ten o'clock in the evening, and having only ten minutes to spare, I soon boarded the East Coast Line passenger which was to carry me to Key West. All night we sped on and when morning came we were well down the Florida coast nearing West Palm Beach.

At West Palm Beach along the railroad tracks I saw several ferns which apparently were *Pteridium caudatum*, *Pteris longifolia*, *Blechnum occidentale*, and *Tectaria trifoliata*. As we traveled farther south where the pines gave way to palms, the trees were often covered with epiphytic ferns. The scenery was now beautiful, orange orchards heavily laden with fruit, bordered with groves of palms. Occasionally we would get glimpses of the Atlantic on the east, but often we would travel over sandy wastes or the swampy land of the everglades.

From the mainland to Key West, a distance of 120 miles, is one of the most remarkable railroads in the

world, literally a railroad through the sea. The narrow islands are connected by concrete trestles or viaducts. At one place we traveled for miles with the sea on either side of us, appearing as though the train was running on the water. Reaching Key West about six in the evening of October the 27th, I soon took passage on the boat that plies between Key West and Havana, Cuba,and by daylight I was in sight of "the Pearl of the Antilles."

Upon arriving at Havana I took the electric car for Guanajay, then went by auto to San Claudio where my friend Mr. Cochran was to meet me. Guanajay is located 31 miles southwest of Havana, and San Claudio is 20 miles west of Guanajay. To the south and stretching one hundred miles or more to the west, lie the mountains of western Cuba. This region, which receives more rainfall than any other part of Cuba, is where most of my collecting was done. Three thousand feet is the highest altitude reached by these mountains. The highest mountains of Cuba are in the east end of the island. Lying to the west of Santiago there are several peaks whose tops tower nearly eight thousand feet.

I only collected a short time near Santiago. In fact my stay in the island was short as I could speak only a few words of the Spanish language and I was greatly handicapped without it. I tried to find a guide to go out with me, but could find no one who could speak both Spanish and English.

My friend, who could speak Spanish, could not spend as much time with me in the woods as I would have liked. Woods I said, I should have said jungle, for if one wandered off the trail he would find himself in a mass of trees and bushes of all sizes held together by vines of various kinds with ferns and orchids thrown in.

In the interests of those who might take to ornithology,

I will say that here was a paradise for birds of various colors and sizes. Here were beautiful hummers, warblers, cuckoos and a robin similar to our northern robin, *Merula migratoria*. This robin probably was *Merula nigrescens*. It had a black breast instead of red and yellow bill and legs and mimicked our northern bird as it ran about on the greensward. A large black and white cuckoo several times larger than our yellow-bill cuckoo was rarely seen but often heard. A very beautiful bird about the size of the robin was seen among the trees, having a coat of many colors, composed of bright red and green mingled with white and black. A small warbler with a coat all green and head yellow was continually hopping about in the low bushes. Our American redstart and Maryland yellowthroat seemed to be at home in the rose-wood trees and shrubbery along the trail. Many others were seen which I cannot mention here.

While on the train going from Havana to Guanajay I saw many ferns I could not make out. I did manage to recognize *Pteris longifolia* and *Acrostichum excelsum* near Arroya Arenas. Near Punta Brava I saw masses of *Anemia adiantifolia* and *Dryopteris normalis*.

San Claudio is only five miles from the Gulf and the same distance from the mountains. I found very few ferns in the town, but as I drew near the mountains there were more ferns in evidence and where the heavy forest set in they were abundant. *Anemia adiantifolia* grew like a weed by the roadside after leaving the town, but in the higher hills it was rare. Tree-ferns, which I fully expected to find plentiful, I saw only once or twice in the higher mountains of western Cuba. They were of one species, *Alsophila myosuroides*. I saw no tree-ferns at all during my short stay in eastern Cuba.

It being the fall of the year, I hardly expected to find orchids in bloom. However, I was agreeably sur-

prised, for growing on rocks and tree limbs and anywhere they could find a footing, I found *Epidendrum cochleatum* L. with waxy flowers of a purple color an inch and a half or two inches across, and with leaves two feet long. In rich woods I found *Habenaria alta* Hook. just beginning to bloom. In the high mountains near Santiago I found two orchids in bloom which Prof. Oakes Ames later reported to be *Warszewiczella discolor* (Lindl.) Reichenb. and *Pleurothallis sertularioides* (Sw.) Spreng. The latter was a tiny little plant with flowers less than a quarter of an inch across.

There seemed to be more ferns in the western part of the island than in the eastern part, as the west end seems to receive the heaviest rainfall. The jungles were more dense in the west than in the east. In the hills near San Claudio one could hardly advance through the woods at all without cutting his way with a machete.

I have presented a set of the ferns collected by me to the National Museum and a set, with a few exceptions, to the Society. Of some very scarce species I collected only a very few specimens. In the short time I was in the island I found only fifty-two species. They are listed as follows.

CYATHEACEAE.

ALSOPHILA MYOSUROIDES Liebm. I only found one large specimen of this tree-fern and one small specimen. The large one was about eight feet high and was a beautiful specimen. It grew at a high elevation south of San Claudio.

POLYPODIACEAE

POLYPODIUM PHYLLITIDIS L. A fern with long, leathery fronds one to three feet long, growing on rocks and trees. Found near San Claudio in Pinar del Rio Province, also in Oriente Province west of Santiago.

P. PILOSELLOIDES L. A small fern growing in masses on rocks and trees at San Claudio and Santiago.

P. EXIGUUM Hew. Similar to *P. piloselloides* and growing with it at San Claudio and Santiago.

P. GLADIATUM Kze. A pinnate fern a foot high growing in rich soil at San Claudio.

P. ANGUSTIFOLIUM Sw. A small fern growing in rich soil at San Claudio.

P. PECTINATUM L. Growing in soil on rocks at 3500 ft. altitude west of Santiago.

P. AUREUM L. On tree-stumps and rocks at 1500 ft. altitude near San Claudio.

P. POLYPODIOIDES (L.) Watt. Found growing on rocks and trees at San Claudio.

DRYOPTERIS SCLEROPHYLLA (Kze.) C. Chr. A large fern growing in rocky ground on shady hillsides south of San Claudio at 1000 ft. altitude.

D. RETICULATA (L.) Urban. A large plant growing in dense shade in ravines at San Claudio.

D. OBLITERATA (Sw.) C. Chr. A very large fern with deeply serrate pinnae in rich shady ravines at San Claudio.

D. SERRA (Sw.) Ktze. A large fern with long narrow serrate pinnae. Growing in limestone in the city of Havana.

D. SANCTA (Sw.) Ktze. A fern very much resembling *D. noveboracensis* of the States, found growing on damp rocks in shady ravines at San Claudio.

D. MEGALODUS (Schkuhr) Urban. A large fern growing high up on the mountainside at Santiago at 2500 ft. altitude.

D. TETRAGONA (Sw.) Urban. Growing in rich, rocky soil at San Claudio.

D. NORMALIS C. Chr. Growing in swampy places south of San Claudio.

D. PATENS (Sw.) Ktze. A fern resembling *D. normalis* but having sharp pointed pinnules instead of blunt as in *D. normalis*. Found at Havana and Santiago at low altitudes.

D. MOLLIS (Jacq.) Hieron. Found growing along the trail at San Claudio.

NEPHROLEPIS BISERRATA (Sw.) Schott. I found one specimen growing on a palm stump at 1500 ft. altitude at San Claudio.

N. EXALTATA (L.) Schott. Growing in the dense jungle in the mountains west of Santiago at 2500 ft. altitude.

ASPLENIUM PUMILUM Sw. Found growing in shade on rocks at San Claudio.

A. CRISTATUM Lam. A very beautiful Asplenium with cut pinnules found in dense jungles on and near rocks west of Santiago at a high altitude.

A. SERRATUM L. A large leathery fern resembling *Polypodium phyllitidis*; growing on rocks at San Claudio.

A. HETEROCHROUM Kze. Growing on large rocks in shade at San Claudio.

A. DENTATUM L. A small fern growing in moist shade near San Claudio.

A. SALICIFOLIUM L. In rich dense woods on rocks at high altitudes west of Santiago.

CHEILANTHES MICROPHYLLA Sw. The only Cheilanthes I found in Cuba. It was found at Havana growing on limestone, also in a rocky dry valley 10 miles west of Santiago. I saw a few plants at Guanajay growing on the tile roofs of some of the houses where they were out of reach.

PITYROGRAMMA CALOMELAENA (L.) Link. Not plentiful, but occasionally met with near San Claudio. One plant was found at a low altitude near Santiago.

ODONTOSORIA WRIGHTIANA Maxon. A very beautiful climbing fern with very finely cut fronds three and four times pinnate. It resembles a very fine lace. Found growing on damp hillsides and in one instance in a valley climbing on bushes at San Claudio.

VITTARIA FILIFOLIA Fée. I found only a few plants growing on the body of a live palm tree along the trail near San Claudio.

DORYOPTERIS PEDATA (L.) Fée. A fern commonly met with in shady woods on rocks, with a triangular deeply cut blade. San Claudio and Santiago.

PTERIS LONGIFOLIA L. Growing on rocks at Havana and at several places along the railroad between Havana and Guanajay.

P. GRANDIFOLIA L. I only found one small plant of this fern in the town of San Claudio, on a rocky cliff.

PTERIDIUM CAUDATUM (L.) Maxon. Growing along the trail near San Claudio.

ADIANTUM CRISTATUM L. Abundant both in Pinar del Rio Province and in Oriente Province. I found some specimens with sharp pinnules and some with truncate pinnules, although both were given the same name by Mr. Maxon.

A. TRAPEZIFORME L. The most beautiful maidenhair I found, having large delicate pinnules, some of them triangular in shape and two or three inches across. Some of the plants stood five feet high. Damp places, San Claudio.

A. FRAGILE Sw. A maidenhair which looked very much like *A. Capillus-Veneris*, growing in damp gullies. Some of the specimens had small wedge-shaped pinnules. All would lose their leaflets in pressing.

A. MELANOLEUCUM Willd. Abundant in shade on hillsides and ravines, San Claudio.

A. CAPILLUS-VENERIS L. Growing on limestone around Havana.

A. VILLOSUM L. A very coarse fern found south of San Claudio. Altitude 800 ft.

A. PULVERULENTUM L. A beautiful plant with curved pinnules found growing near San Claudio.

A. TENERUM Sw. Common around San Claudio.

LYGODIUM CUBENSE HBK. Found by the roadside trailing over bushes and even small trees around San Claudio.

L. POLYMORPHUM (Cav.) HBK. Trailing on bushes at the foot of the mountains near Santiago. All the fronds were sterile.

ANEMIA PHYLLITIDIS Sw. I found only one specimen growing on a rotten log south of San Claudio.

A. ADIANTIFOLIA Sw. One of the most abundant ferns found in Pinar del Rio Province and also found sparingly around Santiago. I found one specimen closely approaching *A. cuneata* Kze.

BLECHNUM OCCIDENTALE L. Along the trail south of San Claudio. Not abundant.

ACROSTICHUM EXCELSUM Maxon. Found in marshes around San Claudio. One colony covered perhaps an acre and stood six or eight feet high.

TECTARIA MARTINICENSIS (Spreng.) Copel. A large fern found at San Claudio growing in rich, shady ravines.

T. HERACLEIFOLIA (Willd.) Underw. Found in rocky woods near the trail south of San Claudio at 1000 ft. altitude.

STOCKPORT, IA.

Osmunda Claytoniana, forma Mackiana

E. M. KITTREDGE

Several years ago while driving near Bridgewater Corners, Vermont, Mrs. Mack of West Woodstock, Vt. noticed a colony of a dozen or more plants of a very curious Osmunda growing close to the road at the base of a steep hillside pasture. In the withered condition of the fronds it was not easy to say whether the plants were forms of *O. cinnamomea* or *O. Claytoniana*. The following year the plants were observed in fresh condition. *O. Claytoniana* was seen to be growing in great abundance and luxuriance a few rods away, the normal plants fruiting abundantly, but no fertile fronds appearing on the odd ones. The station was visited for several

years; always the plants were found beautiful and vigorous, but showing no fertile fronds. Then came a period of a few years when no visit was made. In August of 1920 I visited the station with Mrs. Mack, and to our dismay we found that in the course of widening the road the station had been almost entirely destroyed, only three plants remaining, but they were in fine condition and one bore a fruiting frond, thus proving conclusively its relationship to *O. Claytoniana*. This frond (which can be seen leaning sharply to the left in the accompanying photograph of the growing plant and appears again—the second from the left—in the print of the fronds photographed in the house the next day) and some sterile fronds from each plant were taken at that time. In October Mrs. Mack and Miss Billings visited the place and removed one plant to Miss Billings' fernery, where its growth was watched with much interest during the summer following. It produced two fine fertile fronds and three sterile, but before maturity a storm broke them down. Later three other sterile fronds appeared, but while showing the same odd form they were not half the size of the earlier ones. Late in the summer of 1921 we again visited the original station, and a very thorough search revealed three more plants on the opposite side of the road. The considerable thicket of birch and alder that had screened that side in times past had recently been cut and the place burned over. The new plants showed they had been in the thick of the fire, but small fronds were struggling up from the charred roots and all showed the odd upper portions. Our theory is that when the road was widened these roots were cast into the thicket as rubbish, but had survived their abrupt removal and had grown there contentedly, out of sight, until the cutting and burning revealed them.[1]

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[1] I am indebted to Mr. C. A. Weatherby for assistance in preparing the following description.

OSMUNDA CLAYTONIANA, FORMA MACKIANA—THE GROWING PLANT.

(Photograph by Miss E. M. Kittredge)

Osmunda Claytoniana, forma Mackiana—detached Fronds.
(Photograph by Miss E. M. Kittredge)

Osmunda cinnamomea varies frequently and rather widely and a number of varieties and forms of it have been described. *O. Claytoniana*, on the other hand, is ordinarily very uniform; but when it does, rarely, vary, it quite surpasses its relative. The one variant of it hitherto described, *O. Claytoniana*, forma *dubia* (Grout) Clute, is a remarkable plant in which the pinnules, normally close-set in this species, are separated on the pinnae almost as widely as those of *O. regalis*, and the outer ones are enlarged and pinnatifid. The fertile pinnae are partly foliaceous. The present form is even more curious in that the pinnules of the upper pinnae spread in several planes, as in some of the finely cut horticultural forms of the Boston Fern; and it is much more handsome. So striking a plant may well have a name; it is proposed to call it, in honor of its discoverer,

OSMUNDA CLAYTONIANA L., forma **Mackiana** n. f., fronds rather narrowly lanceolate, of almost the same outline as those of *Dryopteris cristata*, the blades 4.1–7 dm. long, 14 cm. in extreme width; lower 1–3 pairs of pinnae of the usual form, the remainder short, not over 5 cm. long, ovate to deltoid in outline, the mostly enlarged pinnules oblong to deltoid, spreading in different planes and often with 1–3 large obtuse or acute divergent lobes; fertile pinnae normal or often foliaceous and sterile toward the tip, the pinnules then tending to be lobed as in the sterile pinnae.—Shaded roadside at base of a hillside pasture, Bridgewater, Vt., Aug. 22, 1920, *E. M. Kittredge*, TYPE in U. S. National Museum.—PROCTOR, VT.

Recent Fern Literature

Ferns are usually comparatively free from the depredations of insects: in Hawaii, however, an insect has appeared which is causing considerable apprehension because of the damage it may do in the forests whose under-cover is there largely composed of ferns. This insect is the fern weevil, *Syagrius fulvitarsis* Pascoe. It is a native of Australia, first observed in Hawaii in 1903. As usually happens in such cases, it does more damage in its new home than it did in its old one.

The female lays her eggs in the leaf-stalks of ferns, each one in a small cavity about ¼ inch deep which she makes for it. The larva, which lives about fifty days, tunnels in the interior of the leaf-stalk after the usual manner of a borer. The adult, a wingless, warty-looking beetle of grotesque appearance, contributes to the destruction by eating the leaf tissue. Owing to its inability to fly, the spread of the weevil is slow and would be slower were it not carried about on the clothing of men and the hair of animals, and with cultivated ferns which are moved from place to place. Even so, it has become abundant in the Hilo district. Its favorite prey is *Sadleria cyatheoides*, a species with large, soft and fleshy leaf-stalks, but about a dozen other species, including the tree fern *Cibotium Chamissoi*, are attacked.

The forest authorities are fighting the weevil by means of an insect parasite recently discovered in Australia.[1]

A short time since, Dr. W. N. Steil described certain cases of regeneration occurring in the leaves of young plants of *Polypodium irioides* growing in an old laboratory culture. He has now recorded other peculiar cases in the same culture, in which the sex organs, both

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[1]Fullaway, David T. The Fern Weevil. Hawaiian Forester and Agriculturist **18**: 101–114, pl. 1. May. 1921

antheridia and archegonia, produced from certain cells in their own tissue, vegetative growths. These growths were like prothallia arising from the germination of spores and produced perfectly functioning antheridia, but no archegonia.[2]

In the January American Journal of Botany, Miss Mabel R. Hunter has an interesting and detailed account of "The Present Status of Scolopendrium in New York State" (Amer. Jour. Bot. **9**:28–36, figs.1 & 2). The report covers field work extending from 1916 to 1921 and represents the writer's own work, aided by several others, including members of our Fern Society. The writer's own conclusions are interesting:

"1. All described stations for *Scolopendrium vulgare* Sm. in the central New York area have been located, and the fern has been found in greater or less abundance at each.

2. Two new substations for the species have been discovered in the Jamesville area.

3. The number of individual plants in the six colonies of the Jamesville Woods substation was determined in 1916 and again in 1920. Comparison of the data shows the *Scolopendrium* is becoming more abundant."

It is interesting to the reviewer to note that at least one station, the first one he ever found, seems not to be in existence at present. Three stations are noted as existing in the Clarke State Reservation at West Green Lake to which a visit was made by members of the Society some years ago. The stations near East Green Lake are apparently still in existence but are doomed eventually to destruction owing to quarrying operations by the Solvay Process Company which has obtained rights to the limestone east of Jamesville. It is

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[2] Steil, W. N. The development of prothallia and antheridia from the sex organs of *Polypodium irioides*. Bull. Torr. Bot. Club **48**: 271–277, pl. 4, text figs. 1–4. Jan. 1922.

a matter of interest however that the original station for hart's-tongue first reported by Pursh is probably still in existence near "Split Rock" despite the fact that this region to the west of Syracuse has been for years a base for limestone operations for the Solvay Co.

In general it appears that the hart's-tongue has been maintaining itself throughout the years. Its locations are in many cases somewhat inaccessible and practically always require considerable activity in ascending or descending steep slopes. We may hope that this condition will continue. It would seem possible that there might be some opportunity of artificially extending the ranges by transplanting a few plants to situations of proper type not now occupied.—R. C. B.

A new publication, containing matter of considerable interest to fern students, is announced under the title "Official catalog of standardized plant names," prepared under the auspices of the "American Joint Committee on Horticultural Nomenclature." The purpose of the committee in preparing the list was to establish a standard set of names, with scientific approval back of them,which might be recommended for general use for commercial growers as well as for private individuals and scientific institutions. It is expected that the new list will be of particular use in connection with horticultural publications, exhibitions, seedsmen's catalogues, etc.

At present the divergence which exists among scientists in the matter of names is uniformity in comparison with the wide variation to be found in horticultural usage. Not only are incorrect names,—incorrect according to any system of nomenclature.—in common use, but mis-spellings are frequent, corruptions, duplications, and other instances of confusion abound. As an illustration may be cited the fact that in one catalogue listing ferns for house and garden, species of one genus,(*Dryop-*

teris) may be found under the names, *Aspidium*, *Polystichum*, *Nephrodium*, *Lastraea*, and *Phegopteris*.

An indication of the scope of the undertaking and the wide interest is found in the fact that fourteen national organizations are cooperating, including flower, fruit, and plant interests, park executives, landscape architects, pharmaceutical interests and nurserymen. The fern lists were prepared under the supervision of Mr. Maxon. Publication is financed by the organizations interested, the only expense being the bare cost of printing.

Dr. Benedict is publishing from time to time the results of his long study of the varieties of the Boston fern that have developed and been perpetuated under cultivation, and of their origins. Six years ago he gave us an account of the progressive varieties[3]—those in which, in a series of sports in a single line of descent, given characters are intensified. Thus, a twice-pinnate sport gives rise to a thrice-pinnate one, a ruffled sport to one more ruffled and so on. These varieties all represent true and discontinuous mutations: that is, they are not developed gradually through a series of slightly differing generations, but arise by a sudden and definite break in characters between parent and offspring. They are infrequent—one sport only among hundreds of thousands of plants grown. Once having arisen, they are stable, reproducing themselves, in the great majority of cases, true to type. In their manner of origin and in their progressive development, carrying them further from the parent form and nearer and nearer to establishment as recognizably distinct species, they furnish an uncommonly good illustration of the manner in which evolution may have occurred, even if, because of their

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[3] Fern Journal **6**: 8–15, pls. 1–3. Bull. Torrey Bot Club **43**: 207–234, pls. 10–15. Both 1916.

purely vegetative means of reproduction, they are not to be regarded as an actual demonstration of it.[4]

In his latest article, Dr. Benedict deals with some of the regressive variations or reversions which have appeared.[5] By reversion is meant, of course, a return toward the characters of the original parent, as when a twice pinnate form produces a once pinnate sport. Some incomplete reversions, such as the appearance of once and twice or more pinnate leaves on the same stock, familiar to everyone who has grown certain of the divided forms of the Boston fern, are to be regarded as a manifestation of the inherent variability of the forms concerned rather than a real mutation. These are more or less a response to seasonal and cultural conditions. A number of true reversions, in which the forms produced have proved quite stable, have, however, been observed and it is wholly probable that others have occurred in florists' establishments and passed unnoticed there. As in the case of progressive varieties, true reversions are very uncommon in proportion to the number of plants in existence and, as is generally the case with reversions, "complete return to the characters of the parent form rarely, if ever, occurs."

This intermediacy of character and the fact that, for instance, "each of the twenty derivative mutations from *Piersoni* . . . may give rise directly or indirectly to reversions of a *Piersoni* type" reveals the possibility of a "confused tangle of forms" which would well-nigh defy ordinary methods of classification. In the case of plants reproducing sexually, hybridism would certainly be suspected. But here, where reproduction is wholly by runners, hybridism is impossible. Dr. Benedict draws the moral that there is adequate

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[4] Leaflets Brooklyn Bot. Gard. series X, no. 3. 1922.
[5] Am. Journ. Bot. 9: 140–157, pls. v–x. 1922.

reason for caution in making generalizations regarding the similar complexes of wild forms which sometimes are found.

An exhibit of practically all the named forms of the Boston fern has been arranged in one of the plant houses at the Brooklyn Botanic Garden. With them is displayed the chart showing their genealogy which those of us who were privileged to attend the Boston fern show will remember. The immediate parent of each form is also entered on the label accompanying it. In the same house is an exhibit of most of the species of ferns suitable for house plants which are now in cultivation.[6]

HAVE YOU EVER SEEN POLYPODIUM VULGARE AS AN "AIR PLANT?"—"*Polypodium vulgare* as an epiphyte" is the title of an article by Prof. Duncan S. Johnson in the Botanical Gazette for October, 1921. The facts reported are as follows: several plants were seen on a number of chestnut oak trunks, near Cockeysville, Maryland. The plants were of all sizes, showing that they had developed from spores and not merely "crawled" up the trunks through rootstock growth. They occurred mainly on the north side of the trunks, and were found as high as twenty feet above ground. They did not depend on clefts between branches with any accumulation of soil but grew on the sheer sides of straight trunks, favored, however, by the deep ridges characteristic of the chestnut oak. Mosses and hepatics were found in association, covering the roots to some extent.

Prof. Johnson suggests that this fern may be in the way of becoming an epiphyte of temperate regions.

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[6] See the Flower Grower for March, 1922, pp. 53 and 79. The same note has appeared also in The Garden (English), the Florists' Exchange and the Gardeners' Chronicle (of America).

Such plants are common in the tropics, and *Polypodium polypodioides* occurs on trees well into the temperate parts of the U. S. Dr. C. E. Waters in his book on ferns, published a photograph of a plant of *P. vulgare* growing on the branch of a tree; this photograph was taken near Baltimore and perhaps at the very locality where Prof. Johnson's observations were made. Some years ago occurrence of the walking fern on the side of a tree trunk was reported with a photograph in Torreya, but the fern in that case did not grow so high on the trunk and it grew associated with a heavy growth of hepatic or moss. In general the cases are not very dissimilar. Has any reader found instances of this sort? —R. C. B.

ASPLENIUM EBENOIDES—A STATION IN NORTH CAROLINA.—In the early days of our fern hunting, six or seven years ago, my wife and I found a station for this fern in Vermont where most of our fern hunting has been done. We reported this to the JOURNAL. During my Christmas vacation (1921) we decided to go down into the Blue Ridge mountains for two weeks of tramping. How much pleasure it adds to one's rambles when he has fern friends, even in winter, along the way! We reached our destination "Esmeralda Inn," Monday noon, December 19. This Inn is 26 miles, by motor, from Asheville. It is about 1½ miles down the Rocky Broad River from the town of Bat Cave. We had fine weather and we were "on the trail" 6 to 8 hours every day. This country is wild and mountainous. The sun sets early where we were located. When we returned from our daily tramp the four foot wood blazing in the big fireplace gave us a warm welcome.

On Wednesday morning, December 28, we crossed the river on the crude bridge in front of the Inn and

followed down the Rocky Broad River, a matter of a mile or more, then at our right was the beautiful Hickory Nut Falls dropping at once 400 feet over a smooth precipice from an elevation of fully 900 feet above the river. We crossed the creek and started up toward the falls. We saw many plants of *Asplenium platyneuron* and *Camptosorus rhizophyllus* and immediately began to keep our eyes open. About 150 feet from the old roadway and on the high bank above the creek, we found our *Asplenium ebenoides*. It grew out from under a protecting rock and it was mostly covered with the dry leaves but the fronds (seven of them) were all perfect. They were especially fresh and green, they were of nearly uniform length, 5½ to 6 inches, there were a few spores on four of the fronds and three of the tips seemed all ready to take root after the manner of the walking fern. We carefully cut three fronds for our collection. There were a number of dead fronds of a former year's growth. That was a glorious morning, but all fern hunters know how we felt. Mrs. Breckenridge actually found the specimen. I spent three hours next day looking for another but I didn't find one. I feel sure this is a rare fern.—L. P. BRECKENRIDGE, NEW HAVEN, CONN.

American Fern Society

Report of the Treasurer for 1921.

GENERAL FUND

RECEIVED

On hand Jan. 1			$270.63
Received Membership Dues 1919		$ 2.00	
" " " 1920		11.00	
" " " 1921		334.47	
" " " 1922		16.50	
Total dues received		$363.97	363.97
JOURNAL Subscriptions 1920		2.70	
" " 1921		44.61	
" " 1922		7.62	
Total subscriptions		$54.93	54.93
Misc. receipts: advertising		4.00	
interest		2.12	
authors corrections		1.75	
collection fees, etc.		1.00	
Total Misc. receipts		8.87	8.87
Gifts for illustrating Fund			13.50
Sales back numbers, to Emergency Fund			84.00
Total Receipts in 1921		$525.27	525.27
Grand Total			$795.90

PAID OUT

Treasurer's expenses		$ 15.00	
Secretary's expenses		13.88	
Exchange		.40	
Membership Campaign expenses		20.00	
JOURNAL expenses: Budget	$316.00		
Illustrations from Illustrating Fund	6.98		
Total JOURNAL expenses		322.98	
Total Society's expenses for 1921		372.26	
Emergency Fund Transferred to the Special Permanent Fund		110.00	
Total Paid out		482.26	
Balance on hand to 1922		313.64	
		$795.90	

This Balance on hand is divided as follows:—

EMERGENCY FUND

On hand Jan. 1, 1921	$127.34	
Received	84.00	
	$211.34	
Transferred to Permanent Fund	110.00	
Balance on hand	$101.34	
Carried forward		$101.34

Brought forward		$101.34
ILLUSTRATING FUND		
On hand Jan .1	5.91	
Gifts received	13.50	
	$19.41	
Paid acct. of illustrating	6.98	
Balance on hand	$12.43	12.43
HOLDING FROM COUNCIL ORDER		
for printing catalog of Herbarium	$25.00	
From Budget 1920 for Curator's use	8.83	
From Budget 1921 " " "	10.00	
General Fund for ordinary expenses	156 04	
Total general fund on hand	199.87	199.87
Total Balance on hand		$313.64

SPECIAL PERMANENT FUND

On hand Jan. 1	152.66
Recd transfer from Emergency Fund	110.00
*Interest	13.95
	$276.61

Since we have so good a balance in our General Fund, un-appropriated so that it may safely take the place of the Emergency Fund for this year, I recommend that we again transfer $100 from this Emergency Fund to the Special Permanent Fund. It seems to me that it will be exercising good judgment if we continue to transfer this Emergency Fund, which is built up from the sale of Back Numbers of the Journal, to the Permanent Fund until we have at least $500 in this Permanent Fund. After that time a part of the Emergency Fund might well be used to further improve the JOURNAL. A council Order authorizing this transfer will be presented to the Council for its consideration.

Respectfully submitted,
JAY G. UNDERWOOD,
Treasurer.

RARE FORMS OF LIVING FERNS WANTED.—The undersigned desires to obtain for his fern garden, by purchase or exchange, fine crested or other unusual forms of our

---

* A little more interest has not yet been received.

native ferns. Christmas ferns with deeply incised or bipinnate fronds particularly wanted.—*Edward H. Clarkson, Newburyport, Mass.*

Changes of address:—

Allen, Henry V. D., care of International General Electric Co., Schenectady, N Y.

Bates, Miss Ethel ,Box 239, South Berwick, Me.

Heatley. Miss Margaret, to Mrs. C. E. Moss, Box 1176, Johannesburg, South Africa.

Overacker, Miss Minnie L., 127 Robineau Road, Syracuse, N. Y.

Young, John P., Ithaca, N. Y.

New Members:—

Bill, Mrs. Sara Perkins (Mrs. G. E.), 819 3rd St., Harrisburg, Pa.

Birger, Dr. Selim, Greturegatan 3, Stockholm, Sweden.

Kemp, Prof. J. D., Schermerhorn Hall, Columbia University, New York City.

McIntire, Mrs. Jessie, 3450 Oaklane Ave., Minneapolis, Minn.

Rust, Miss Sarah H., 6 Beacon St., Boston, Mass.

Schulz, Miss Ellen L., in the list of members, should read Schulz, Miss Ellen D.

T. Chalkley Palmer is studying the genus *Isoetes* and would be glad to receive specimens for identification. He would be particularly pleased to receive plants from the Rocky Mountain region.

Our new member Dr. Selim Birger, of Stockholm, wishes to exchange pteridophytes with American botanists. Dr. Birger says, "I have a great number of duplicates of Scandinavian and European ferns, also some from Celebes, Sumatra etc."

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EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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The Distribution of Southern California Pteridophytes.

Philip A. Munz[1] and Ivan M. Johnston[2]

The purpose of this paper is to bring up to date the available information on the distribution of Southern California pteridophytes. The last comprehensive treatment of this subject was by Parish (Fern Bull. **12:** 1–15. 1904), in a discussion of the fern flora of California. As his paper dealt with the whole state, distribution for the southern part was not given as definitely as might be wished; furthermore much additional information has accumulated in recent years and has made it seem desirable that there be made a critical restatement of the whole subject. This paper is the outcome of special study of the literature; of comprehensive herbarium-work, in which all the important herbaria of the state were examined; and finally, of several years collecting in practically all parts of Southern California.

As here used, "Southern California" is, as generally understood, those counties east and south of Santa Barbara County and the desert portion of Kern County south of the Tehachepi Mountains. Included in the range also are the Channel Islands which lie just off

[1] Pomona College, Claremont, Calif.

[2] University of California, Berkeley.

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the coast of Southern California. Mention is made also of records from Inyo County, which is a continuation of the same phytogeographic area as that to the south, only when light is thereby shed on Southern California distribution, but no reference is made to certain strictly Sierran species occurring there.

Roughly speaking, Southern California consists of three parts: coastal, mountain, and desert. The coastal is that part west of the mountains and draining directly into the Pacific Ocean. The desert area is that lying east of the mountains and constituting the Mohave and Colorado Deserts. The mountain area is that series of high ridges dividing the two former areas; the most important sections are known as the Mt. Pinos region, the San Gabriel, the San Bernardino, San Jacinto, and Cuyamaca Mountain ranges.

In trying to assign to each species considered its life-zone, we have in general followed the Merriam system as applied by Hall (Univ. Cal. Pub. Bot. **3:** 9–12. 1907), and Abrams (Bull. N. Y. Bot. Gard. **6:** 307–322. 1910). But we have assigned all the region west of the mountains to the Upper Sonoran Zone, excepting only small unimportant areas in San Bernardino and San Diego Counties.

The climate of Southern California is universally conceded to be dry, but it is a remarkable fact that there grow in this area no less than fifty species of pteridophytes. This situation is only to be explained by the diversity of habitat and range of altitude. It does not seem necessary to enter into a detailed discussion of the characteristics of the fern flora taken as a whole, since this subject has been very interestingly set forth by Parish (Am. Fern Jour. **5:** 97–104. 1915), but in this connection the following table is worth noting:

TABLE 1. NUMBER OF PTERIDOPHYTES IN SO. CALIF.

Polypodiaceae	33 sp. and 4 vars.
Ophioglossaceae	3 sp.
Marsileaceae	2 sp.
Salviniaceae	1 sp.
Isoetaceae	2 sp.
Selaginellaceae	6 sp.
Equisetaceae	4 sp.
Total	**51 sp. and 4 varieties.**

In an attempt to make the paper more useful, we have given keys to the genera and species and have listed illustrations, particularly those latter which were based on West American material. It has been thought best to cite authorities and references for many locality records. We have attempted, however, to distinguish between those localities which we know only through the literature and those from which we have examined material. The localities marked with an exclamation sign are those from which we have seen specimens which we believe to be correctly named as indicated. When definite localities have been given, we have usually given a reference or cited specimens; if the latter and the collection is unnumbered, we have indicated the herbarium in which it was seen. We have attempted also to verify all records and to indicate all errors and misidentifications existing in the literature concerned with our area.

The authors know only too well that the present paper does not exhaust the subject. the preparatory study having shown how little definite information there is regarding the fern flora of Southern California. It is our intention to continue such study and any information or material will be welcomed.

We acknowledge our indebtedness to many collectors and workers who have kindly given us notes, specimens,

and opinions; among them we may mention: Dr. A. Davidson, Mrs. H. M. Hall, Mr. E. C. Jaeger, Dr. W. R. Maxon, Mr. G. L. Moxley, Mr. S. B. Parish, Mr. F. W. Peirson, Dr. Norma Pfeiffer, Mr. Fred Reed, Mrs. G. R. Robertson, Dr. J. H. Schaffner, and Mr. H. H. Tracy.

Pteridophytes

KEY TO FAMILIES

A. Spores produced in sporangia borne in the axils of scale-like or grass-like leaves.
  B. Leaves small, scale-like; plant of moss-like aspect and of dry situations. VI. SELAGINELLACEAE.
  BB. Leaves grass-like; plant apparently stemless and of onion-like aspect, of moist situations. V. ISOETACEAE.
AA. Spores not produced as above.
  B. Sporangia produced in terminal cone-like spikes; stems tubular and jointed VII. EQUISETACEAE.
BB. Sporangia not in cones, stems not as above.
  C. Plant small, one-leaved; each leaf bearing an erect fertile spike or panicle. II. OPHIOGLOSSACEAE.
  CC. Plant small to large, more than one-leaved; leaves producing sporangia on under side or in special sporocarps.
    D. Fern-like, homosporous. I. POLYPODIACEAE.
    DD. Not fern-like; heterosporus.
      E. Leaves distinctly petioled, not crowded; blade present or absent. III. MARSILEACEAE.
      EE. Leaves minute and loosely imbricated on pinnately branched stems. IV. SALVINIACEAE.

I. POLYPODIACEAE.

KEY TO GENERA

A. Sporangia marginal, with leaf-edge more or less incurved and covering them.
  B. Reflexed leaf-margin not continuous appearing as separate large indusia; ultimate segments of frond at least 1 cm. broad; maidenhair ferns. 13. ADIANTUM.
  BB. Reflexed leaf-margin continuous, or if discontinuous ultimate segments of frond 1–3 mm. broad.

C. Fronds conspicuously dimorphous; fertile pinnae very narrow; high montane. 12. CRYPTOGRAMMA.

CC Fronds uniform or nearly so.

D. Stipes light colored, not brown; fronds ternate; an inner indusium present, making the covering of the sori double; fronds large and coarse, 3–12 dm. long. 14. PTERIDIUM.

DD. Stipes dark, brown to purplish (light in *Pellaea andromedaefolia*); no inner indusium present; fronds ½–3 dm. long.

E. Sori naked, leaf-margin scacely if at all inrolled. 10. NOTHOLAENA.

EE. Sori covered with inrolled leaf-margin.

F. Inrolled leaf-margin continuous; pinnules 3–10 mm. long, thick and leathery. 9. PELLAEA.

FF. Inrolled leaf-margin not continuous or if continuous pinnules only 1–3 mm. long and beadlike, less firm, not thick nor leathery. 11. CHEILANTHES.

AA. Sporangia on back of frond, not at the margin, leaf-margin not incurved.

B. No indusium present, sporangia naked.

C. Fronds once pinnate; stipe light colored; sporangia in definite circular sori in two rows on each pinna. 15. POLYPODIUM.

CC. Fronds more than once pinnate, stipe dark; sporangia not in circular sori but in bands.

D. Plants not powdery below, or if powdery below with slightly inrolled margin. 10. NOTHOLAENA.

DD. Plants powdery below and margin not inrolled. 8. PITYROGRAMMA.

BB. Indusium present, covering sporangia.

C. Indusium distinctly longer than broad in outline.

D. Sori in chain-like rows parallel to the midrib of the pinnule; large coarse fern with fronds 4–6 ft. high. 7. WOODWARDIA.

DD Sori oblique to the midrib of the pinnules.

E Sori straight; fronds simply pinnate, not over 1½ dm. long. 6. ASPLENIUM.

EE. Sori curved; fronds at least bipinnate, over 3 dm. long. 5. ATHYRIUM.

CC. Indusium circular in outline, peltate or reniform.

D. Indusium orbicular, centrally attached; leaves once pinnate, basal pinnae sometimes bipinnate; texture coriaceous. 4. POLYSTICHUM.

DD. Indusium not centrally attached; leaves at least bipinnate thoughout; texture not coriaceous.

E Stipes slender, less than 1½ mm. in diam.; blade of frond 1–1½ dm. long and ½–¾ dm. wide.

F. Indusium under the sorus, with stellate divisions.

1. WOODSIA.

FF. Indusium hood-like, fixed on one side with broad base.

2. CYSTOPTERIS.

EE. Stipes coarser, 2–4 mm. in diam.; blade of frond 2½–5 dm. or more long, 1–2 dm. broad.

F. Indusium distinctly reniform and quite circular in outline, attached along the sinus.

3. THELYPTERIS.

FF. Indusium merely curved, elongate rather than round, attached along the inner side.

5. ATHYRIUM.

1. WOODSIA.

WOODSIA OREGANA D. C. Eaton, Can. Nat. II **2:** 90. 1865.

Physematium oreganum Trev. *Woodsia obtusa* var. *Lyallii* Hook.

Illus.: Eaton, Ferns No. Am. pl. 71, fig. 1–4. 1880.

In Southern California this fern has been collected only in the San Bernardino Mountains! where it is infrequent about rocky places on north-facing slopes above 7000 ft. altitude in the Canadian and Transition zones (*Munz 6237, 6302;* Parish, Zoe **4:** 167. 1893. Fern Bull. **12:** 11. 1904. Fl. World **20:** 170. 1917); in the Santa Rosa Mts.! where it occurs in similar situations (*Munz 5868, 5890*); in the Providence Mts.! where a few plants were collected by the authors in moist gravel in a narrow gulch at 4,200 feet in the Upper Sonoran Zone; and in the Panamint Mts.! where it has been collected at 9,300 ft. alt. in Hanaupah Canyon (*Dixon*, U. C. Herb.). The Providence Mountain collection was erroneously reported as *W. scopulina* (Munz & Johnston, Bull. Torrey Cl. **49**: 31. 1922).

2. CYSTOPTERIS.

CYSTOPTERIS FRAGILIS (L.) Bernh. Schrad., Neues Journ. Bot. 1[2]: 27. 1806. Brittle fern. Bladder fern.

Polypodium fragile L. *Filix fragilis* (L.) Underw. Illus.: Frye & Jackson, Am. Fern Jour. **3:** pl. 7, f. 5–6. 1913. Hall, A. Yosemite Flora p. 39. 1912. Eaton, Ferns No. Am. pl. 53, f. 1–8. 1880.

Restricted to the higher mountains where it occurs in varying abundance in wet places from the Upper Sonoran to the Canadian Zone, from 3500 to over 9,000 ft. alt., and in drier rocky places of northern exposure up to the tops of the highest peaks. In our range known only from the mountains of Ventura County! (*Dudley & Lamb* 4547), the San Bernardino Mts.! (Parish, Pl. World **20**: 170, 1917),San Gabriel Mts.! (Johnston, Pl. World **22**: 79. 1919), San Jacinto Mts.! (*Jaeger 274*, *Munz & Johnston 5386*, and *Hasse*, Dudley Herb.), and mountains of San Diego County! (*Stokes*, Dudley Herb., and *Abrams 3798*).

3. THELYPTERIS.

A. Veins of pinnules simple; indusium hairy T. AUGESCENS.

AA Veins of pinnules freely forking; indusium not hairy.

B. Lower basal pinnule usually with a semicordate base, this over-lying the primary rachis; veinlets all ending in salient, spine-like teeth; common at middle and low altitudes. T. ARGUTA.

BB. Lower basal pinnule not semicordate at base, and not overlying the primary rachis; veinlets fewer, usually ending in curved teeth; rare, at high altitudes. T. FILIX-MAS.

THELYPTERIS **augescens** (Link), n. comb.[3]

Sweet fern. Spreading wood-fern.

In wet ground in shaded canyons in the Upper Sonoran Zone, below 3000 ft. altitude. Known in our

[3] *Aspidium augescens* Link, Fil. Sp. B rol. 103. 1841. *Aspidium puberum* Fée, Mém. 40. 1865. *Dryopteris Féei* C. Chr. Ind. Fil. 264. 1905. *Dryopteris augescens*, var. *puberula* C. Chr. Vid. Selsk. Skr. VII. **10**. 184. 1913. *Thelypteris normalis* Moxley Bull. So. Cal. Acad. Sci. **19**: 57. 1920. ***Thelypteris Féei* Moxley op. cit. 20: 34. 1921.**

range from only a few stations: Santa Barbara! (Parish, Fern Bull. **12:** 10. 1904); Eaton Canyon!, San Gabriel Mts. (Parish, Muhlenbergia **3:** 57. 1907); Roberts and Fish Canyons, San Gabriel Mts. (acc. to Moxley, in lit.); and Tahquitz Canyon!, Colorado Desert base of the San Jacinto Mts. (*Labouchere*. U. C. Herb.). This is the plant which, until recently, was almost universally known in California literature as *Aspidium* or *Dryopteris patens*. Christensen, however, has shown that the true *Aspidium patens* of Swartz is a different species, occurring in tropical America. Moxley has called our California plant *T. Feei*, but it does not seem to be essentially different from any of the Mexican forms of *T. augescens*, as defined by Christensen. All these forms appear to be best treated as belonging to a single species; we are accordingly taking up the specific name *augescens*, the oldest applicable to the concept.

THELYPTERIS ARGUTA (Kaulf.) Moxley. Bull. So. Cal. Acad. **19:** 57. 1920.

Wood fern.

Aspidium argutum Kaulf. *Aspidium rigidum argutum* D. C. Eaton. *Dryopteris rigida arguta* (Kaulf.) Underw. *Lastrea arguta* Brack. *Nephrodium argutum* Diels. *Nephrodium rigidum argutum* Davenp. *Dryopteris arguta* (Kaulf.) Watt.

Illus.: Eaton, Ferns No. Am. pl. 46. 1880. Hall, A Yosemite Flora, p. 38. 1912.

Common on shaded coastal slopes of the Upper Sonoran Zone below 3500 ft. alt.; ascending occasionally into Lower Transition Zone to 6500 ft. alt.! Approaching the desert at Warners Hot Springs! (*Coomb*, Cal. Acad. Herb.); known also on Catalina Island! (Brandegee, Zoe **1:** 115. 1890), Santa Cruz Island! (Greene, Bull. Cal. Acad. **2:** 415. 1887), and Santa Rosa Island! (Brandegee, Proc. Cal. Acad. (2) **1:** 218. 1888). The *Aspidium aculeatum* of Lyon's list (Bot. Gaz. **11:** 334.

1886) from Catalina is probably to be referred here (Brandegee, Zoe **1:** 148. 1890).

THELYPTERIS FILIX-MAS (L.) Nieuwl. Am. Mid. Nat. **1:** 226. 1910.

Male fern. Sweet fern.

Polypodium Filix-mas L. *Aspidium Filix-mas* Sw. *Dryopteris Filix-mas* (L.) Schott. *Polystichum Filix-mas* Roth. *Nephrodium Filix-mas* Rich.

Illus.: Eaton, Ferns No. Am. pl. 41, 1879. Frye & Jackson, Am. Fern Jour. **4,** pl. 9, pl. 11, f. 3 & 4. 1914. Britton & Brown, Illus. Flora, **1,** fig. 45. 1913.

Among rocks in Holcomb Valley! in San Bernardino Mts. Only a single collection is known from Southern California, that was made by Parish Brothers in August, 1882, at 8000 ft. alt. (Parish, Fern Bull. **12:** 10. 1904 and Maxon, Am. Fern Jour. **11:** 4. 1921). No doubt through a slip of the pen, Maxon accredited this fern to Snow Canyon instead of Holcomb Valley (Am. Fern Jour. **11:** 107. 1921).

(To be continued)

Ferns as House Plants.[1]

R. C. BENEDICT.

Ferns! What does the word bring to mind? To me it recalls the outdoors; woodland, streamside, mountain slopes. Ferns suggest tropical forests and jungles; or, to let the thought run back in time, ferns call up vistas of ancient vegetation when no flowering plants existed. Then ferns were the predominant plant type, and from the dead ferns and similar plants of that period, by some extraordinary reduction process, we have coal.

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[1] **Reprinted also as a Leaflet of the Brooklyn Botanic Garden. The plants illustrated were grown at the Brooklyn Botanic Garden, and the photographs for the illustrations were made by Louis F. Buhle, Garden photographer.**

But ferns are not merely denizens of the wild, remote and untamable. They are a common sight along city streets, in store windows. Retail florists' shops show dozens of plants. Commercial growers throughout the country raise literally millions of fern plants every year, and these find their way eventually into hundreds of thousands of homes. What characteristics have ferns that make them the most successful of all house plants?

If you will let your thought seek for a moment the distinguishing feature of ferns, you will realize that their individuality is expressed almost entirely in their leaves. The word "fern-like" presents a picture of a feathered leaf, with serried leaflets along two sides of a median stalk. Such a leaf may be long and narrow, or short and broad; the division may be reduplicated several times, but always the feathered cutting suggests a fern. As a matter of fact, ferns offer also leaves of all imaginable shapes, simple and undivided, hairlike or broad, mosslike or leathery, clinging, et al.

Ferns as house plants offer, then, leaves in infinite variety of shapes, of types of division, of shades of green. Some are even variegated with white, red, and other colors. Thoreau's characterization, "Nature made ferns for pure leaves," cannot be too often quoted. To it may be added the fact that although Nature made ferns millions of years ago, she has never since surpassed the beauty of the fern leaf type in the leaves of later manufacture. Secondly, a good house fern is continuously beautiful throughout the year. It does not depend for its attractiveness upon the occasional production of transitory flowers. Such a fern plant will last longer, even in the unfavorable conditions of a dwelling house, than practically any kind of flowering plant.

CARE OF FERNS IN THE HOME

Success with plants in the home—ferns or any other

plants—is really a matter of human nature. Do you admire and appreciate the beauty of a living plant? Besides a simple esthetic appreciation, do you realize that a plant is a living, growing being—an eating, breathing, drinking, feeling organism, which thrives or pines according to its environment and the care it receives? Can you take enough interest in a plant pet to study and understand its few and simple needs, and systematically to supply these—a daily drink of water, good light, pure air, cleaning, and an occasional new supply of soil food and root space?

With many people, particularly in cities, a plant is mainly a means of temporary decoration, to be used like a picture or hanging, according to the needs of the room. They would like to have it remain beautiful indefinitely, but—"I don't know what is the matter. I can't seem to make plants grow." Under the frequently unsatisfactory conditions of city homes no one can make plants grow successfully. With poor light, gas fumes, and overheated rooms, it should be thoroughly understood that plants are to be considered merely as temporary decorations, like flowers, but lasting weeks or months where flowers last days. If the place to be decorated happens to be a well lighted window, and the plant receives a daily drink, it may surprise its hosts by refusing to die even months after its arrival, but it will probably wear out its welcome in its cumulative decrepitude.

In the country and in smaller cities especially, there are those who like to try to *grow* plants in their homes just as others keep birds, dogs, cats, or other animal pets. Their idea is not so much that here is a dark corner in which a plant would look well, or here is a dining table (in the middle of a dark room) which needs a plant centerpiece. Some people like plants. They enjoy trying to keep them growing successfully from one year to

the next. With that point of view, the arrangement of the room becomes secondary to the interests of the plants. These are given the best window in the house, without intervening curtains. Their care is as much a matter of the daily routine house work as the preparing of meals, etc.

As a matter of fact, both viewpoints may be justifiable. House plants are beautiful as part of the scheme of home adornment, even though they require replacement at rather frequent intervals. They are also interesting as living things, to be cared for and studied.

The essential principles of house plant care have already been indicated above. Applied to ferns, and reduced to definite rules, they may be stated as follows:

1. Water regularly, a little every day. Do not let the plant become dried out. A parched fern looks gray and dull, and droops. Do not keep the soil so wet that it is muddy. When a fern has "wet feet" continually, its leaves turn yellow.

2. Keep the temperature moderate, not over seventy, nor under fifty, unless the plant is semi-hardy, as will be described below. Ventilate the room if gas is used, but do not stand the fern in strong drafts.

3. Clean the leaves if they become dusty or buggy. The leaves are best washed when the air is such that they will dry off quickly, though not in hot summer sun.

4. Give the plant the best lighted window in the house, a sunny window except perhaps in the hottest summer days. The florist often grows his ferns in full sunlight the year around, but he keeps the air moist, a condition not possible in houses. Do not rotate the plant with the idea of making it develop symmetrically. All the new leaves will be under-developed, and only those toward the light will benefit by the light at any one time. You have never seen leaves growing naturally facing away from the light.

5. If all the preceding requirements have been met, the fern should increase gradually in size until it becomes rootbound. Repotting is best done in May or June, and if the plant can then be plunged into the soil, pot and all, in a shady corner of the yard, the summer out-of-doors will be reinvigorating, and the new growth strong. During the year, fertilizer may be given in the form of weak sodium nitrate solution, Clay's fertilizer, or any leaf food.

The first three rules are concerned merely with maintaining the fern in the condition received as long as possible. The last two rules have to do with the quality of the new growth. With the conditions of the florist's greenhouse as ideal, the aim should be to make the home environment approximate as nearly as possible the ideal. The resulting plant will be a compound of three factors, the individuality of the plant itself, the environment supplied, and the personality of the owner of the plant.

THE BEST KINDS OF HOUSE FERNS.

Since the question of house plants is of particular interest to the home maker, I asked the arbiter of a home in which I am acquainted just what she wanted to know about ferns as house plants. "How they look and how they last," was the answer which really epitomizes the whole problem of selecting house plants in general. What ferns look best, are most decorative? Which kinds last, remain decorative for the longest time?

The matter of looks is largely one of personal taste. Different people fancy different types. Among the forms illustrated and described a wide variety exists. Some are smooth, some ruffled; some are dark green and glossy; others paler with dull surface. Some may grow to a height of two to four feet or more; others never become more than a foot tall. Some are divided in typical

feathery fern fashion; others are tasselled, forked, or otherwise subdivided. One not uncommon in florist's establishments, though not shown here, has simple sword-shaped leaves (bird's-nest fern). All are attractive in appearance.

One further point as to culture may be made. The florist divides cultivated plants in general into four classes according to their temperature requirements, viz.; "hardy," "semi-hardy," "greenhouse," and "stove," the latter requiring the highest temperature. The ferns suitable as house plants all belong in the second or third class.

Ferns classified as semi-hardy come originally from warm temperate regions, where they were accustomed to rather cold winters. For this reason they do best when allowed to rest most of the winter, and they are well suited to be kept in rooms which are kept fairly cool, with the windows opened perhaps at night as in sleeping rooms, provided the temperature does not go below freezing too long. Some of them do well in an outdoor garden from Philadelphia southward.

The other class, the so-called "greenhouse" ferns, hails from subtropical climates, like southern Florida. At home their growth slackens during winter but does not entirely stop, and they cannot stand temperatures below forty. Even below fifty is undesirable.

In general, the semi-hardy kinds make tougher, better lasting leaves, which stand up even under neglect for a long time. The subtropical varieties form fuller, more compact plants, and continually replace older leaves with new fresh ones if growth conditions are sufficiently good.

The semi-hardy varieties illustrated in this paper are all included in three genera, *Dryopteris*, *Polystichum*, and *Cyrtomium*. Among the subtropical forms, ten genera are represented. The names used are based on the

recently adopted standardized list of cultivated plant names which has been adopted as official by the various florists' associations and other organizations. At present, the trade nomenclature of common cultivated plants is in a sad state of confusion, but the newly determined list is a long step toward uniformity, though it will take considerable time before the information is assimilated throughout the body of commercial florists at large.

Semi-hardy varieties

Cyrtomium falcatum (Plate 5, figure 1). Holly fern.

The variety illustrated is var. *Rochfordianum compactum*, introduced by Dreer, a dwarf sport of the Rochford variety brought out in England. Another variety, *Mayi*, has forked and crested leaf tips and pinnae. Any of these holly fern varieties are excellent for the house; lasting, as well as beautiful. The leaves grow in a circle from a scaly crown, after the fashion of our wild Christmas fern, but the pinnae of the holly fern are much broader, and in the Rochfordianum, beautifully ruffled and lobed, dark glossy green, one to two feet long. Native in Pacific Islands and Asia.

Polystichum adiantiforme (*P. coriaceum*, a better known name). (Plate 5, figure 2.) Leather fern.

Another excellent house fern, to which the illustration does less than justice. It is tall-growing, with a creeping, scaly stem; the leaves, which may reach two to three feet in height, are triangular, three- to four-pinnate, and extremely tough and lasting. It has been planted in Florida to some extent for use in the cut-leaf trade. Native in South Africa.

Polystichum tsus-simense (*P. "tensemense"* as sometimes corrupted in the florist's trade). (Plate 5, figure 3.) Tsusima holly fern.

Twenty-one house ferns shown in small plants

A small fern, twelve to fifteen inches high, forming compact clumps of several tufted crowns of leaves. The leaves are rather dark green, dull, twice pinnate, erect. With *Cyrtomium*, it is one of the commonest ferns grown as "table" ferns, for filling baskets and fern dishes. Native in the Japanese islands.

Dryopteris viridescens (Plate 5, figure 4). Glossy wood fern.

Offering perhaps the most beautiful leaves of the entire list. The leaves develop in a circle, are three-pinnate, one to two feet long, pale green at first, with spinulose segments. It is of the type of our wild *D. intermedia*, though well distinguished. Native in China.

Dryopteris Sieboldii (Plate 5, figure 5). Siebold's wood fern.

An odd triangular-leaved fern, with a few large broad pinnae. In the fertile leaves the pinnae are contracted. The leaves spread horizontally, and are about a foot long at most; dull, pale green. Native in China and Japan.

Subtropical varieties

Adiantum cuneatum (Plate 7, figure 7). Delta maidenhair.

Probably more people have heard of maidenhair ferns than of any other single kind. Our common wild species is only one of over a hundred species, nearly all of which are tropical. Of all the species, *A. cuneatum*, in some of its varieties, is best adapted to house conditions, but its leaves have such a thin, delicate texture that success cannot be promised, although plants may be kept for some time. The plant illustrated is known as var. *California*. Native in South America.

Davallia solida (Plate 5, figure 16 and plate 6, figure 2). Glossy davallia.

Davallia is best known for two other Japanese species formerly sold commonly as "fern balls," i.e., bundles

1. BEAR'S-FOOT POLYPODY. 2. SHINING DAVALLIA. 3. EARED SPEENWORT. 4. MILLS' BOSTON FERN. 5 TUBER FERN. 6. VERONA FERN. 7. EMMEL SELAGINELLA.

of rhizomes in a resting condition, made up with moss and starting into growth with watering. The species illustrated has a harder glossier leaf, triangular, tripinnate, about a foot long at most, from a creeping rootstock, and makes a very attractive little plant. Native in Polynesia and Australia.

Asplenium auritum (Plate 5, figure 17 and plate 6, figure 3). Spleenwort.

A little, bipinnate species, with slender divisions, the leaves growing about a foot at most. Not a recognized house fern, but included here to illustrate the genus. A more common, cultivated asplenium, the bird's-nest fern, *A. nidus*, was not available in small size. Native in American tropics.

Nephrolepis cordifolia (Plate 5, figure 19 and plate 6, figure 5). Tuber fern.

A good house fern, though not so well known as the following. The leaves are narrow, usually with blunt pinnae, dull, pale green, erect and spreading. One form has scaly tubers of the size of walnuts. The leaves are particularly resistant to drying, retaining their form under conditions which would cause many fern leaves to wilt and die. Native in tropics.

Nephrolepis exaltata. Sword fern.

No description of house ferns would be complete without the inclusion of varieties of the sword fern or rather, its variety, *bostoniensis*, deservedly the most widely grown of all cultivated ferns. Although not as hardy as the holly fern and others of that type, the stronger Boston fern varieties do well under house culture, and may be continued year after year with proper care. With one hundred named forms to choose from, the present article shows only two of distinct type. Native in tropics generally.

1. RIBBON BRAKE. 2. ALEXANDRA BRAKE. 3. WILSON'S BRAKE. 4. MAY'S BRAKE. 5. RIVERTON BRAKE. 6. GREEN CLIFF BRAKE. 7. DELTA MAIDENHAIR.

"Mills' Boston" (Plate 5, figure 18 and plate 6, figure 4).

A new, compact, once pinnate variety, less than one-third the size of the Boston fern itself, but adapted in its size to smaller space, and particularly good because of its tough, lasting leaves.

Verona fern. (Plate 5, figure 20 and plate 6, figure 6.).

A three-pinnate variety of Boston fern, probably the best of the lace type for house conditions, and commonly offered in the trade.

Onychium japonicum (Plate 5, figure 6). Carrot fern.

Japanese claw fern.

The carrot fern is a delicately pretty little species, sometimes sold as a table fern, but unsuited to ordinary house conditions. It would succeed better in a Wardian case or under a large bell jar. The leaves are slender, three-pinnate, with narrow segments, suggesting somewhat a carrot leaf. Native in Japan, China, Java, etc.

Pellaea viridis (*Pteris adiantoides* of trade.) (Plate 7, figure 6). Green cliff-brake.

Tall-growing, one to two feet, two- to three-pinnate, with dark brown, wiry, stalks and midribs, and dark dull green, ovate, segments. A commonly sold table fern which will grow in the house with reasonably good care. Native in South Africa.

Pityrogramma Martensii (Plate 5, figure 7). Gold fern.

The particular gold fern which was available for illustration is very sensitive and not suitable for house use, but there are two or three hardier species which may be counted possible house plants. They are:—*P. triangularis*, California gold fern; *P. sulphurea*, Jamaica gold fern; and *P. tartarea*, silver fern. They are easily distinguishable by the covering of yellow or whitish powder on the underside of the leaves.

Polypodium aureum (Plate 5, figure 15 and plate 6, figure 1). Bear's-foot fern. Golden polypody.

This tropical American species, occurring in Florida, is not well known as a house plant, but will succeed none the less with ordinarily good care. The ruffled variety illustrated, var. *Mandianum*, Manda's polypody, is most attractive. Under greenhouse conditions, the leaves will reach a length of six feet, arising separately from the creeping, scaly rootstock; but in the house, it will not grow so tall. Native in American tropics.

Pteris cretica (Plate 5, figure 10). Cretan brake.

After the Boston fern varieties, the next most common house fern types are found in the genus *Pteris*, and *P. cretica* offers the most varieties. They will generally grow well under the conditions proper for the Boston fern, but require more top light to make well shaped plants. Native in Europe and Asia; and in Florida. The following varieties are among the best.

albolineata (Plate 7, figure 1). Ribbon brake.

Like the wild form, except that through each leaf division there runs a distinct white line of variegation.

Alexandrae (Plate 7, figure 2). Alexandra's brake.

A crested form of the preceding, with tasselled tips.

major (Plate 5, figure 10). Plain green, about like the species.

Mayi (Plate 7, figure 4). May's brake.

A crested, variegated form, with the leaf divisions forking lower than in *Alexandrae*.

Rivertoniana (Plate 7, figure 5). Riverton brake.

Has broad, full pinnae, irregularly lobed and ruffled.

Wilsoni (Plate 7, figure 3). Wilson brake.

One of the most commonly grown varieties, clear green with tasselled tips, forming a compact plant.

Wimsetti multiceps (Plate 5, figure 11). Wimsett brake.

Somewhat like *Rivertoniana* but with tasselled tips, and narrower pinnae.

Pteris ensiformis (Plate 5, figure 12). Sword brake.

Grown mainly in the variety *variegata* or *Victoriae*, Victoria brake or "Queen fern" (Plate 5, figure 13), but also in a ruffled variety, *Sieboldi*, Siebold's brake (Plate 5, figure 2). It is an interesting little species, with dimorphic leaves, the fertile always much taller, and erect. Used by florists to give variety in height in baskets and fern dishes. Native in Asia.

Pteris quadriaurita argyraea (Known in trade as *P. argyraea*). (Plate 5, figure 8.) Silver brake. Striped brake.

A very attractively variegated variety which will reach three feet or more under greenhouse conditions. Not easy for house culture. It is used by florists in small sized plants for its color effect in connection with plain green ferns. Native in eastern Asia.

Pteris multifida (*P. serrulata*, the best known name) (Plate 5, figure 9). Spider brake.

Similar to *P. cretica*, but with much narrower divisions of the leaf. The variety illustrated, *cristata*, crested spider brake, is beautifully tasselled. There are numerous forms, some variegated. Native in Eastern Asia.

Pteris tremula (Plate 5, figure 14). Australian brake.

A large species when full-grown, but mainly in small sizes. It is easier to grow than *P. quadriaurita argyraea*. The leaves are clear green, divided somewhat after the fashion of our wild brake, *P. aquilina*. Native in Australia.

Selaginella Emmeliana (Plate 5, figure 21). Emmel selaginella.

The selaginellas are not ferns in a true sense, although they are often grouped with ferns, both horticulturally and botanically. The genus includes some of the most beautifully colored of all vegetative plant growths, some showing various colors with an iridescent sheen. *S. Emmeliana*, and its yellow form, *aurea*, are rather common with florists, and will stand house culture if the water supply is never neglected. Parched for a day, however, they wither and lose their beauty, although they will make a good new growth after some time. In the illustration (Plate 6, figure 7) what appears to be a leaf is really a "frond" in the original meaning of that term, that is, a leaf-like structure, made up of a branching stem with numerous small leaves.

The twenty-eight varieties just described do not by any means exhaust the different kinds grown in this country by florists, and useful as house plants, but they will serve to give a general idea of what is available. Eighteen of the twenty-eight were obtained from one grower who specializes in ferns (Dreer of Philadelphia) as representing his stock. The others were added from the Brooklyn Botanic Garden collection to give a greater variety. The pictures show plants practically all in uniform sized pots, and are intended to afford a comparison of the various kinds at about the same stage of growth. In some cases the small plants give a very inadequate representation of the character of the forms concerned. However, with pictures and description combined, readers should be able to make a preliminary determination of their preferences. Since the plants are generally offered by retail florists in even smaller sizes, the illustrations should better serve the purpose of identification than would pictures of fully developed plants.

BROOKLYN BOTANIC GARDEN

Variation in Ferns.

R. C. BENEDICT

In connection with the article in this number on ferns for the house, attention may be called to the different types of variation indicated by the plants illustrated. Briefly, these may be summarized as follows:

1. *Dwarfing*: The Mills Boston fern is a very good illustration, being less than a third the size of the normal Boston fern; also the dwarf holly fern, *Cyrtomum falcatum Rochfordianum compactum.*

2. *Ruffling*: Several of the varieties illustrated show ruffling. Manda's polypodium, the Siebold pteris, the holly fern, and the Riverton pteris all show considerable ruffling of the pinnae, together with the irregular lobing of the margins which always seems to accompany this character. An additional point is the fact that ruffled ferns are usually less fertile than the plane-leaved types.

3. *Variegation:* The presence of a white stripe down the middle of the pinnae is shown in several of the pteris varieties illustrated: *P. cretica albolineata, P. cretica Alexandrae, P. ensiformis Victoriae, P. cretica Mayi, P. quadriaurita argyraea.* It occurs also in a *Polystichum, P. aristatum*, which is a common trade fern.

4. *Cresting:* This is one of the commonest types of variation in wild as well as in cultivated ferns. As it appears in cultivated varieties, it seems to be a permanent characteristic, repeated in the spore progeny. Among wild plants it sometimes seems that cresting merely affects a single leaf or two occasionally.

5. *Division:* The best illustration of variation in division, among the plants figured, is shown by the Verona variety of Boston fern. This is a common occurrence, however, both among cultivated ferns and to a less extent among the wild forms. A distinct twice-

divided Christmas fern form has been found more than once. (Fern Bull. July 1907, and October 1909).

6. *Sterility:* Reference has already been made to the fact that ruffled varieties are generally less fertile than the normal types. Apparently, also, sterility may sometimes appear to be the only distinction between the normal form and the new type. The Boston fern, as compared with the wild sword fern, its ancestor, differs mainly in the fact that it produces no fertile spores. To be certain of sterility, it is necessary to make a careful examination under the microscope of the contents of often apparently fertile sori.

7. *Spiral Twisting:* A single form of Boston fern with leaves curiously twisted in irregular spiral fashion is under cultivation. As many as seven complete rotations have been noted in a single leaf. In another *Nephrolepis* form, the twisting takes a form which causes the pinnae to stand out at all points of the compass instead of being arranged in two rows extending in opposite directions.

8. *Determinate Grouth:* Among Boston ferns and, in fact, in the genus *Nephrolepis* in general, it is a rare thing to find the tip of the leaf completely unrolled. Dr. Small reports the wild species of Florida reaching lengths of over twenty feet primarily due to indeterminate growth. Two or three varieties of Boston fern, however, have shown the ability to complete the leaf tip.

9. *Viripary:* A recent horticultural form of Boston fern has added the ability of the leaves to produce new bud plants to the other characteristics of the genus. So far as I know no other form or species of *Nephrolepis* is able to bear buds on the leaf.

10. *Apospory:* Investigators of some of the cultivated forms of unusual sports of *Dryopteris* have reported that occasionally new prothallia may be produced directly from the margin of a normal leaf, that is, leaving out the necessity of development of prothallia from spores.

It has always seemed to me possible that some of our native species of *Dryopteris* may be found to do the same thing, especially some of the hybrid types which have no fertile spores, but which form large clumps in a favorable location.

It would be extremely worth while for members of the Fern Society to bear in mind the possibilities of variation which have been detected already partly among wild forms, but especially in cultivated types as indicated above. For example, there is every reason to expect that eventually a variegated form of some of the common wild species will turn up. In general, variegation represents a loss of vigor for the plant, so that such a plant would then need to be transplanted to a garden where it could receive careful attention.

Mr. Weatherby has written outlining five types of Christmas ferns which he has seen. Classified according to the list of variations, they represent namely: 1.—The normal form. 2.—A crested form. 3.—The ruffled type. 4.—A twice-pinnate type. 5.—Another division form not distinctly twice-pinnate. I should be very glad to receive plants of any distinct forms of Christmas ferns which members may find or if whole plants are not available, to receive fertile leaves which show the variation. In view of the fact that the cultivated variety of the sword fern, specifically the Boston fern, has been found to give rise to so many and unusual new varieties, it will be interesting to make a thorough study of the dagger fern (*Polystichum acrostichoides*) with its similar leaf cutting, to see whether it may not also be in the process of variation and potential evolution of new forms. Of Mr. Weatherby's list of five forms, I have found four: a most distinctly ruffled type, a completely twice pinnate type, and the twice pinnatifid form, together with the normal. Is not the common sensitive fern an illustration of ruffling fixed in a wild species?

Mr. Waters writes in a recent letter: "In collecting for my herbarium, I always got as many different forms of a species as possible. Forking fronds interested me, but not as much as normal ones showing intangible and indescribable variations in leaf cutting." In this connection, it may be added that in the Boston fern series of varieties occur forms distinguished by reflexed pinnae, by blunt tips, by different colored stipes and rachides, by different shaped bases of the pinnae, by the brittleness of the leaf stalks, et al. Such differences remain constantly distinguishable throughout years of cultivation and vegetative reproduction of the varieties concerned.

BROOKLYN BOTANIC GARDEN.

A LIST OF FERNS FOUND IN WOODSTOCK, CONN.—The three Osmundas; *Botrychium virginianum*, *B. obliquum* (common locally, with a fair sprinkling of forma *dissectum*), *B. matricariaefolium* (one station) and *B. simplex* (one station); *Ophioglossum vulgatum* (one station, recently discovered); *Pteris aquilina*; *Woodsia obtusa*; *Polystichum acrostichoides*; *Dryopteris Thelypteris*, *D. noveboracensis*, *D. simulata*, *D. marginalis*, *D. cristata*, and *D. spinulosa* and its variety *intermedia*; *Asplenium platyneuron* and *A. Trichomanes*; *Athyrium acrostichoides* and *A. Filix-femina*; *Polypodium vulgare*; *Phegopteris polypodioides* and *P. hexagonoptera*; *Cystopteris fragilis*; *Dennstaedtia punctilobula*; *Adiantum pedatum*; *Onoclea sensibilis* and *O. Struthiopteris* (one station).

Woodsia ilvensis is found a short distance outside of Woodstock's borders. *Onoclea Struthiopteris* seems to be extremely rare here, but is found outside the town limits.

The first *Botrychium obliquum* I was privileged to find was a *dissectum* form and was growing by our front

wall. It was not only the largest of its kind that I ever found, but was also the most finely dissected. It was fertile. I recently made the acquaintance of *Ophioglossum vulgatum* in its favorite haunt, a wet, mossy meadow.

Botrychium simplex has not before been reported from northeastern Connecticut. The height of this fern varies from small specimens of but an inch or even less in height (but fertile) to larger ones of from six to eight inches. It appears in early May, about two or three weeks later than *B. matricariaefolium*, and, of course, the spores ripen correspondingly later. The one station was a side-hill or bank, with a small brook at the base, in deciduous woods with a rich soil. An area of about fifteen square feet contained probably thirty to forty specimens. A few more were discovered not far from this colony and it is possible that a painstaking search among the dead leaves would have revealed still more. Other ferns growing near were *Polystichum acrostichoides, Athyrium acrostichoides, Adiantum pedatum, and Botrychium virginianum.*

Both *Botrychium matricariaefolium* and *B. simplex* usually wither and die before the middle of summer, the stipes appearing to decay first near the base, thus weakening them and causing the ferns to recline.—ALAN W. UPHAM.

FERNS IN THE NEWS.—Every city has one or more newspapers which show a special interest in natural history to the extent of publishing frequently articles on plants and animals. In a recent issue of Science, Mr. Cosgrove, Sunday Editor of the New York World, wrote of the interest in science taken by his paper, and the care exercised to see that the articles should be scientifically accurate. This care for accuracy is really

a most significant indication of the type of reader to which a newspaper caters. Another New York paper, not noted for accuracy in any respect, published a year or so ago a whole page on carnivorous plants, in which, mixed with mainly accurate accounts of the small insectivorous sundew and Venus fly trap, there were included a photograph of a East Indian pitcher holding a dead rat, an obvious fake, and an artist's drawing with appropriate text, detailing an annual sacrifice of a young Indian woman (shown white in the picture!), to a man-eating plant of South America. To what grade of intelligence must this paper appeal?

The New York Evening Post has daily articles by "The Naturalist" as well as other nature stories, all reliably written. The story appended, reprinted by permission, is a good illustration. Apparently the Naturalist, man or woman, is familiar with Long Island, as the series includes frequent stories of Long Island bird observations and of coast-wise fish, as well as alternate stories of plants.

AN IRREPRESSIBLE FERN.

Neither fire, nor storm, nor flood can kill some plants, and one at least has come through the recent disastrous forest fires without a scratch. Bracken, or the common brake, certainly the most widely distributed fern in the world, is plentiful in the burned areas, and its new fronds are already coming up, Phoenix-like, among the dead ashes of the forest ruins.

So widely distributed is this largest of our local ferns, and such enormous growths does it make in some countries, that its extermination is necessary over vast tracts of grazing land. In New Zealand, for instance, where sheep grazing lands are valuable and hard to keep from invasion by worthless plants, a curious practice has grown up around the bracken. At the dry season hundreds of acres are fenced, set on fire, and then sheep are turned into them. The animals can only eat the young, succulent shoots, as the mature growth, as in our native representatives, is hard and wiry. Just the right number of sheep are turned in so that "fern crushing" is complete and forage grasses get a chance to grow. The operation

is widely followed in New Zealand, where bracken is even more common than it is here. Locally it is more plentiful in dry, rather sandy regions than elsewhere, and it often makes great, branching fronds over four feet high, the stalks of which are hard, black, and wiry.

In Normandy and Brittany, bracken, the cut-off stem of which simulates a holy symbol, has for ages been used by the peasants to ward off witches from their pastures. And at least one book on religious botany says that its fresh foliage was used, among innumerable other "cradle grasses," to line the cradle at Bethlehem.

Another news article, from a Syracuse paper, tells of a local fern garden with fifty-two species harbored in a back yard at one time, most of them from Onondaga County woods. Francis B. Gregory, of 725 East Willow St., is the fern grower. Other Syracuse fern students' may be interested to make his acquaintance.

WHAT FERNS SHOULD BE PROTECTED IN YOUR STATE? —In New York state, the Vermont list might well be duplicated, as far as the same species occur with us. Of course we should add the hart's tongue, and the climbing fern of which records exist, though it may be too late to save the latter. *Asplenium montanum* and *Cheilanthes lanosa* would also demand protection; also the rarer botrychiums, though the commerical plant seller would scarcely be an enemy of these, only the thoughtless botanical collector. Again I refer to the Vermont list published in the preceding issue of the Fern Journal, to cover *Dryopteris Goldiana*, and others sufficiently prized by the plant sellers to be in danger. Have I left out any others?—R. C. B.

The third of a note-worthy series of plant exhibits was held by the Massachusetts Horticultural Society in

Horticultural Hall, Boston, from May 3d to 13th. This was an exhibition of native ferns and flowering plants. Plants from various parts of New England, and regardless of their natural flowering season, had been potted months previous in preparation for this exhibit and so treated as to bring them into flower for the occasion.

The setting was elaborate and impressive. On entering the exhibition hall the spectator found himself in a wooded glade. At the far end a roaring stream plunged over a rocky ledge midst overhanging bladder ferns into a pool whence it flowed under a rustic bridge and through a bit of moist meadow where grew many moisture loving flowers and ferns, showy ladies slipper, pitcher plant, cardinal flower, high bush blueberry, rhodora, the osmunda family, marsh fern, ostrich fern, and even the humble sensitive fern. On the embankments at the foot of the spruce trees that bordered the glade was a fine show of azaleas, laurels, viburnums, the flowering dogwood, etc. Here grew most of the wood ferns and the rock ferns. The ferns respond well to conservatory treatment and they looked vigorous and well developed. The completeness of the list of ferns exhibited is well illustrated by the presence of such rarities as *Lygodium*, *Woodsia hyperborea*, *Dryopteris fragrans*, and two or three fine plants of Scott's spleenwort (*Asplenium ebenoides*) with the two parent species growing near.

Public interest was so great that the week of the exhibit was prolonged to a total of eleven days. Over 12,000 visited the exhibit in a single day and the estimated total attendance was over 100,000.

Congratulations are due the Horticultural Society and its president, Mr. Albert C. Burrage, upon the successful outcome of this unique and ambitious undertaking.

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R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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American Fern Journal

Vol. 12 OCTOBER–DECEMBER, 1922 No. 4

The Distribution of Southern California Pteridophytes.

Philip A. Munz and Ivan M. Johnston[1]

4. POLYSTICHUM.

A. Fronds once pinnate, 3 to 9 dm. long; middle altitudes. *P. munitum.*

AA. Fronds with basal pinnae again pinnate, less than 3 dm. long; high altitudes. *P. scopulinum.*

Polystichum munitum (Kaulf.) Presl. Tent. Pterid. 83. 1836.

Sword Fern.

Aspidium munitum Kaulf. *Dyopteris munita* Kuntze. *Nephrodium plumula* Presl. *Polystichum plumula* Presl. *Aetopteron munitum* (Kaulf.) House.

Illus.: Eaton, Ferns No. Am. pl. 25, f. 1. 1879. Hall, A Yosemite Flora, p. 38. 1912. Frye & Jackson, Am. Fern Jour. **4**, pl. 12, f. 1: pl. 13, f. 1–2. 1914.

Occurring only on the coastal slopes, where abundant on shaded stony canyon sides of the Upper Sonoran Zone, usually above 3000 ft. alt. This fern, typical of the upper chaparral belt, occasionally extends to much higher altitudes (Johnston, Pl. World **22:** 79. 1919) and reaches an altitude of at least 8600 ft! (*Munz 6087*). Reported from below 1500 ft. alt. near Box Springs Mts. east of Riverside by Reed (Muhlenbergia **5:** 94. 1909). Occurring on Santa Cruz Island! (Greene, Bull. Cal. Acad. **2:** 415. 1887).

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[1] Continued from p. 77.

[Vol. 12, no. 3 of the Journal, pages 69–100, plates 5–7, was issued Dec. 13, 1922]

POLYSTICHUM SCOPULINUM (D. C. Eaton) Maxon. Fern Bull. **8:** 29. 1900.

Aspidium aculeatum var. *scopulinum* D. C. Eaton. *Aetopteron scopulinum* (D. C. Eaton) House.

Illus.: Eaton, Ferns No. Am. **2**, pl. 62, f. 8. 1880. Frye & Jackson, Am. Fern. Jour. **4**, pl. 13, f. 8. 1914. Britton & Brown, Illus. Flora, **1:** f. 35. 1913.

Known in our range only from Snow Canyon! in the San Bernardino Mts. where it is locally abundant in rock-crevices in the Hudsonian Zone (Parish, Zoe **5:** 110. 1901. Fern Bull. **12:** 11. 1904. Pl. World **4:** 229. 1901, and **20**: 170. 1917), and from the divide between Little Rock Tributary and Bear Creek in the San Gabriel Mts.! where it grows in the Transition Zone at 6500 ft. alt. (*F. W. Peirson 2464*).

5. ATHYRIUM.

ATHYRIUM FILIX-FEMINA (L.) Roth, var. CALIFORNICUM Butters. Rhodora **19:** 201. 1917.

Lady fern.

Illus.: Hall, A Yosemite Flora, p. 37, f. 1. 1912.

Occasional in boggy places and along streams in the Transition Zone of the San Jacinto! (McClatchie, Proc. of So. Cal. Acad.: 393. 1897.) and of the San Bernardino Mts.! (Parish, Pl. World **20:** 170. 1917). It also occurs on Santa Cruz Island! (Greene, Bull. Cal. Acad. **2:** 416. 1887). In the mountains the lady fern takes on two forms, one with rather narrow, strict fronds and forming close clumps, the other with more lax, delicate, ample fronds and forming loose clumps in sheltered situations. On Santa Cruz Island the latter type only is found.

6. ASPLENIUM.

ASPLENIUM VESPERTINUM Maxon. Bull. Torrey Cl. **27**: 197. 1900.

Illus.: Maxon, Contr. U. S. Nat. Herb. **17**: 142, f. 3. 1913.

Growing in moist shaded places under rocks in hills and canyons of the coastal slopes in the Upper Sonoran Zone, below 3000 ft. alt. Fairly common in San Diego County! (Maxon, Contr. U. S. Nat. Herb. **17**:142. 1913). In Los Angeles County it has been collected in Puddingstone Canyon! of the San Jose Hills (*Munz, Street & Williams 2454*), and in most of the canyons along the southern base of the San Gabriel Mts. from Millards Canyon! to San Gabriel Canyon! In San Bernardino County known only from Cucamonga Canyon! in the San Gabriel Mts. (*Johnston 80, 2172*). In Riverside County it has been found only in the hills south of San Bernardino (Parish, Fern Bull. **12**: 9. 1904), and in Leach Canyon! on the east base of the Elsinore Mts. (*Munz 5036.*) This fern is the *A. Trichomanes* var. *incisum* of the Bot. Cal. **2**: 344, 1880 and of latter authors. Type locality at San Miguel Mt., San Diego County.

7. WOODWARDIA.

WOODWARDIA CHAMISSOI Brack. Wilkes U. S. Explor. Exped. **16**: 138. 1854.

Great chain fern.

Woodwardia radicans Smith var. *americana* Hooker, in part.

Illus.: Eaton, Ferns No. Am. pl. 61. 1880. Frye & Jackson, Am. Fern. Jour. **4**, pl. 16, f. 3–4. 1914. Hall, A Yosemite Flora, p. 36. 1912.

Frequent, often forming dense thickets 4 to 6 ft. high, in boggy places in shaded canyons on the coastal slopes; occurring in the Upper Sonoran Zone and ascending to an elevation of 5000 ft. Reaching the edge of the desert, as at Laguna Mts.! (*Eastwood 9248*), Warners Hot Springs! (*Buttle*, Cal. Acad. Herb.), Tahquitz Canyon! (*Labouchere*, U. C. Herb.) and Whitewater! (*Vasey 14*). On the islands it has been found only on Santa Cruz! (Greene, Bull. Cal. Acad. **2**: 415. 1887). Earlier authors

have placed our plants under *W. radicans* and *W. spinulosa*, but we here accept the narrowly limited species-conception of Maxon (Am. Fern Jour. **9**: 68. 1919).

8. PITYROGRAMMA.

PITYROGRAMMA TRIANGULARIS (Kaulf.) Maxon. Contr. U. S. Nat. Herb. **17**: 173. 1913.

Goldenback fern. Goldfern. Silverback fern.

Gymnogramme triangularis Kaulf. *Gymnogramme triangularis* var. *viscosa* D. C. Eaton. *Neurogramme triangularis* (Klf.) Diels. *Gymnopteris triangularis* Underw. *Ceropteris triangularis* Underw. *Ceropteris viscosa* Underw. *Pityrogramma triangularis* var. *viscosa* Weatherby. *P. triangularis* var. *Maxoni* Weatherby.

Illus.: Eaton, Ferns No. Am. pl. 48, f. 1–4 for *P. triangularis* and f. 5 for var. *viscosa*. 1880.

This species is common throughout our range, frequenting dry gravelly and stony ground at altitudes usually below 3000 ft.; extending occasionally to near 5000 ft. Off the mainland it has been found on Santa Cruz and Santa Rosa Islands (Brandegee, Zoe **1**: 147. 1890 and Proc. Cal. Acad. (2) **1**: 205 & 218. 1888); and on Catalina! and San Clemente (Lyon, Bot. Gaz. **11**: 334 & 335. 1886). This fern exhibits several geographically correlated tendencies which have been indicated and named by Weatherby (Rhodora **22**: 117 & 119. 1920). For our range these consist of a glutinous, usually white-backed form from the coastal portions of San Diego! and Orange Counties! and from Catalina Island!, and known as the variety *viscosa*. This variety has been considered distinct enough by some authors for treatment as a separate species. The common form in the region west of the mountains is usually yellow-backed and is not glutinous nor glandular; this is the typical form of the species. In some localities, as at

Laguna Beach! and Catalina Island!, the variety *viscosa* and the typical *triangularis* grow together. The desert form which is frequent in rocky canyons and on mountain sides of the Lower Sonoran Zone, and which differs from the typical form in the presence of glands on the upper surface and in usually having a paler under surface, is Weatherby's variety *Maxoni*. It must be understood that these are ill-defined varieties and that most material is difficult of determination; this situation is especially true in the case of the variety *Maxoni*.

9. PELLAEA.

A. Pinnules obtuse, not at all mucronate, 4–8 mm. wide; stipe straw-colored to light brown. *P. andromedaefolia.*

AA. Pinnules acute and mucronate, 1–3 mm. wide; stipe dark brown.

B. Leaves tripinnate, pinnules generally in groups of three; a plant of the valleys. *P. mucronata.*

BB. Leaves bipinnate, pinnules generally single; a plant of the mountains mostly. *P. mucronata* var. *californica.*

PELLAEA ANDROMEDAEFOLIA (Kaulf.) Fée. Gen. Fil. 129. 1850–52.

Coffee fern.

Pteris andromedaefolia Klf. *Allosorus andromedaefolius* (Klf.) Kunze. *Platyloma andromedaefolia* J. Smith. *Nothochlaena andromedaefolia* Keys. *Pellaea rafaelensis* Moxley.

Illus.: Hall, A Yosemite Flora, p. 34. 1912. Eaton, Ferns No. Am., pl. 27, f. 1. 1879. Moxley, Am. Fern Jour. **5**, pl. 8. 1915.

Common in rocky soil in the washes and in the hills on the coastal slopes of the Upper Sonoran Zone, ascending the lower canyons to about 3000 ft. alt. Approaching the desert in the region of Warners Hot Springs! (*Buttle*, Cal. Acad. Herb.) and Palm Springs! (*Munz 4697*). On the islands it can be reported as occurring on Catalina! (Brandegee, Zoe **1**: 115. 1890), San Clemente!

(*Evermann*, Cal. Acad. Herb.), Santa Cruz! (Greene, Bull. Cal. Acad. **2:** 415. 1887) and Santa Rosa (Greene Proc. Cal. Acad. (2) **1:** 218. 1888). When the plant grows in exposed situations, it may take on a reddish color, a condition which was described as var. *rubens* (Eaton, Bull. Torrey Cl. **6:** 360. 1879. & Ferns No. Am. **2:** 275. 1880). A slightly pubescent form has been collected at San Diego and called var. *pubescens* (Baker, Syn. Fil. 150. 1867).

PELLAEA MUCRONATA D. C. Eaton, Torr. Mex. Bound. Surv., 233. 1859.

Birds-foot fern.

Pellaea ornithopus Hook. *Allosorus mucronatus* D. C. Eaton. *Allosorus ornithopus* Kuntze.

Illus.: Hooker, Sp. Fil. **2,** pl. 116. 1858. Hall, A Yosemite Flora, p. 33. 1912. Eaton, Ferns No. Am. pl. 47, f. 7–10. 1880.

Common throughout our range in gravelly or stony soil, on the coastal slopes of the Upper Sonoran Zone. Ascending the mountains to 4500 feet alt. and extending to the edge of the desert as at Mountain Springs! (*Hall*, U. C. Herb.), Warners Hot Springs! (*Buttle*, Cal. Acad. Herb.), Palm Springs! (*Johnston*, Baker Herb.), Little San Bernardino Mts.! (*Munz & Johnston 5225*), and Victorville! (*Johnston 2502*). It has been collected on Catalina Island! (Lyon, Bot. Gaz. **11:** 334. 1886.) and Santa Cruz Island! (Greene, Bull. Cal. Acad. **2:** 415. 1887.). This fern was called *P. ornithopus* until Maxon revived the older specific name which we are using (Maxon, Proc. Biol. Soc. Wash. **30:** 180. 1917.).

PELLAEA MUCRONATA D. C. Eaton, var. **californica** (Lemmon), n. comb.[4]

Illus.: Hall, A Yosemite Flora, p. 33. 1912.

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[4] *P. Wrightiana* Hook. var. *californica* Lemmon. Ferns of Pac. Coast. p. 10. 1882. *P. Wrightiana compacta* Davenp. Cat. Davenp. Herb. Suppl. 46. 1883. *P. compacta* Maxon. Proc. Biol. Soc. Wash. **30:** 183. 1917.

Common on dry gravelly slopes of the Transition Zone in the San Jacinto! (Parish, Fern Bull. **12:** 8. 1904), San Bernardino! (Parish, l. c.), and San Gabriel Mountains! (Johnston, Pl. World **22:** 79. 1919), and in the Mt. Pinos region! (*Dudley & Lamb 4648*). Similar plants occur in the Upper Sonoran Zone in the desert region as at Pilot Knob! (*Johnston 5568*), the Providence Mts.! (Parish, l. c.) and in the Panamint Mts.! (*Jepson 7036*). The type was collected in the San Bernardino Mts. As indicated in a letter from Parish to Maxon (Maxon, Am. Fern Jour. **8:** 89. 1918), this fern occupies an area apart from that occupied by *P. mucronata*. It grows according to our observations in the arid pine belt of the higher mountains at from 5000 to 8000 ft. alt., and in the desert region far removed from the range of typical *mucronata*.

This plant has been current in California literature under *P. Wrightiana* and the names listed. In describing the species *P. compacta*, Maxon distinguishes it from *P. mucronata* by its "simple, less sharply mucronate pinnules, its congested habit, its long-stipitate fronds and its more broadly striped rhizome scales." Careful investigation of a good series of specimens convinces us that these characters do not vary together. Intermediates are common and exhibit every combination of the above characters. The most striking difference is in the arrangement of the pinnules and we have thought it best to refer to the variety those plants in which the fronds are bipinnate or predominantly so; the variety is further substantiated by a fairly distinct geographic range.

10. NOTHOLAENA.

A. Fronds not at all hairy nor scaly.

B. Fronds covered with a yellowish or white powder, especially below; blade deltoid; pinnae close. *N. californica.*

BB. Fronds not at all powdery; blade lanceolate; pinnae remote.
N. Jonesii.

AA. Fronds hairy or scaly.

B. Fronds scaly, once pinnate or bipinnatifid.
N. sinuata.

BB. Fronds woolly; bipinnate or tripinnatifid.

C. Fronds averaging 10–15 cm. long; tomentum close; plant not at all viscid; a species of coastal slopes.
N. Newberryi.

CC. Fronds averaging 7–12 cm. long; tomentum very loose, plant more or less viscid; a desert species.
N. Parryi.

NOTHOLAENA CALIFORNICA Eaton, Bull. Torrey Cl. **10:** 27. 1883.

In and about rocks and cliffs of Upper and Lower Sonoran Zones. Common about Palm Springs! and southward along the western edge of the Colorado Desert, as at Mountain Springs (Maxon, Contr. U. S. Nat. Herb. **17:** 603. 1916). On the Mohave Desert known only from near Victorville! (Munz & Johnston, Bull. Torrey Cl. **49:** 32. 1922). On coastal slopes the known stations are: Sweetwater Valley, San Diego Co. (Maxon, l. c. and Kimball, Fern Bull. **19:** 43. 1911); Temescal Canyon! (Johnston, Bull. So. Cal. Acad. **17:** 64. 1918); near San Jacinto! (*Munz & Johnston 5551*); Slover Mountain! near San Bernardino (Parish, Bot. Gaz. **15:** 51. 1890 and Maxon, l. c.); and Catalina Island (Maxon, l. c.). Treated in Bot. Cal. (**2:** 336. 1880) as *N. candida*, in most later references as *N. cretacea* until Eaton's *N. californica* was reinstated by Maxon (l. c.). Type locality given as San Diego County.

NOTHOLAENA JONESII Maxon, Am. Fern Jour. **7:** 106–109. 1917.

Illus.: Eaton, Ferns No. Am., pl. 43, f. 9–11. 1879.

A very rare fern of the desert region, occurring in rock-crevices in the Upper Sonoran Zone, at least in several cases on limestone cliffs. The following stations

are on record: northern base of San Bernardino Mts.! (Parish, Erythea **1**: 153. 1893 and Plant World **20**: 169. 1917), Palm Springs! (Parish, Erythea **1**: 154. 1893), Piute Peak on Mohave Desert (Parish, Fern Bull. **12**: 6. 1904), Providence Mts.! (Brandegee, Zoe **5**: 153. 1903 and Munz & Johnston, Bull. Torrey Cl. **49**: 32. 1922), and Panamint Canyon (Maxon, l. c.). Mention should also be made of the questionable record from mountains of Santa Barbara Co. (Yates, Bot. Gaz. **11**: 181. 1886 and Parish, Erythea **1**: 154. 1893). From the first discovery this species has been treated as *N. tenera* until recently shown to be distinct by Maxon.

NOTHOLAENA SINUATA (Swartz) Kaulf. var. INTEGERRIMA Hook. Sp. Fil. **5**: 108. 1864.

Notholaena laevis Mart & Gal. *N. cochisensis* Goodding.

Illus.: Eaton, Ferns No. Am. pl. 39, f. 1–6. 1879.

Locally abundant on a rocky hillside in a gulch back of the Bonanza King Mine, Providence Mts.!, Mohave Desert (Munz & Johnston, Bull. Torrey Cl. **49**: 31. 1922).

NOTHOLAENA NEWBERRYI D. C. Eaton, Bull. Torrey Cl. **4**: 12. 1873.

Cottony fern.

Illus.: Eaton, Ferns No. Am., pl. 39. f. 11–14. 1879.

In our range common about dry rocky places in the lower hills of the Upper Sonoran Zone at elevations less than 1500 ft. Occurring commonly in coastal San Diego!, Riverside!, and Orange Counties!: sparingly in Los Angeles Co., as in hills south of Pomona! (*Baker 4733*), Rubio Canyon! (Davidson Herb.) and San Gabriel! (*Brewer 135*); and in San Bernardino County, where it is known from a single collection at Upland! (*Johnston 35*) and just over the county line in the hills south of San Bernardino!. The only specimen seen from the desert edge is from near Warners Hot Springs!

(*Buttle*, Cal. Acad. Herb.). It occurs also on San Clemente Island! (Lyon, Bot. Gaz. **11**: 335. 1886). Once reported from the Providence Mts. in eastern California (Brandegee, Zoe. **5**: 153. 1903) but that record was shown by Parish (Bot. Gaz. **65**: 334. 1918) to have been based on a misdetermination. The type locality is near San Diego.

NOTHOLAENA PARRYI D. C. Eaton. Am. Nat. **9**: 351. 1875.

Illus.: Eaton, Ferns No. Am., pl. 74, f. 5–9. 1880.

Frequent, often in great abundance locally, in rocky places in the desert region: occurring in the lower portions of the Upper Sonoran Zone up to about 4000 ft. alt. and in the Lower Sonoran Zone. There are numerous collections from about Palm Springs! (Pember, Am. Fern Jour. **2**: 13. 1912), from there extending southward to Mountain Springs! (Maxon, Am. Fern Jour. **10**: 3. 1920) and Yaqui Wells! (*Eastwood 2642*); eastward to Shavers Well! (*Jaeger*, Baker Herb.), Eagle Mts.! (*Munz & Keck 4823*), and Chuckawalla Mts.! (*Munz & Keck 4798*); extending northward along the east base of the San Bernardino Mountains to the Little San Bernardino Mts.! (*Munz & Johnston 5203*), Ord Mts.! and Victorville! Present also in the Providence Mts.! (*Munz & Johnston*, Bull. Torrey Cl. **49**: 32. 1922) and in the Panamint Mts.! (Coville, Contr. U. S. Nat. Herb. **4**: 22. 1893), where it is reported from 6000 ft. alt.

11. CHEILANTHES.

A. Indusia not continuous; fronds glabrous or if hairy more or less glandular-viscid.
  B. Fronds deltoid, not at all viscid. *C. californica.*
  BB. Fonds narrowly elongate, more or less viscid.
    C. Fronds conspicuously hairy at base of stipe only; desert species. *C. viscida.*

CC. Fronds hairy throughout; a species of coastal hills.
C. Cooperae.

AA. Indusia continuous; fronds scaly or wooly.

B. Fronds woolly beneath.

C. Fronds without scales or coarse fibers. A fern of the eastern part of the Mohave Desert. *C. Feei.*

CC. Fronds either with scales or fibers. About the San Jacinto Mts.

D. Rachis with scales; pinnules loosely woolly below.
C. Parishii.

DD. Rachis with coarse fibrils; pinnules densely woolly below
C. fibrillosa.

BB. Fronds covered with imbricated scales below.

C. Rhizome creeping; stipes not closely placed on it. Scales on under side of frond uniform chestnut-brown and abundantly ciliate; blade of frond usually 6-10 cm. long.
C. Clevelandii.

CC. Rhizome short and branching, intricate; most of the stipes closely placed. Scales white to brown, scarcely if at all ciliate; blade of frond usually 10–15 cm. long.
C. Covillei.

CHEILANTHES CALIFORNICA (Nutt.) Mett. Abh. Senck. Nat. Gesell. **3**: 88. 1859–61.
Lace fern.

Aspidotis californica Nutt. *Hypolepis californica* Hook. *Cheilanthes amoena* A. A. Eaton.

Illus.: Eaton, Ferns No. Am., pl. 6, f. 2. 1879.

Common on shaded cliffs and slopes of the Upper Sonoran Zone in the counties fronting the ocean; extending through the low passes into the coastal portion of Riverside County to the hills south of San Bernardino!, and from the ocean along the southern slope of the San Gabriel Mts.! to the Los Angeles County line. Reported also from Catalina Island (Brandegee, Zoe **1**: 115. 1890). The Santa Cruz Island reference by Greene (Bull. Cal. Acad. **2**: 415. 1887) is referable to *C. Clevelandii* (*myriophylla* acc. to Brandegee, Zoe **1**: 147. 1890).

CHEILANTHES VISCIDA Davenp. Bull. Torrey Cl. **6**: 191. 1877.

Illus.: Eaton, Ferns No. Am., pl. 12, f. 1. 1879.

Occasional about rocks of the Lower Sonoran Zone. First collected and best known from the region about Palm Springs! and from there extending southward along the western edge of the Colorado Desert to San Felipe Canyon! (*Brandegee*, U. C. Herb.), Masons! (Brandegee, U. C. Herb.), and Mountains Springs! (*Parish 9029*). On the Mohave it is known only from the Panamint Mts.! (Coville, Contr. U. S. Nat. Herb. **4**: 227. 1893). Type locality is Whitewater, near Palm Springs.

CHEILANTHES COOPERAE D. C. Eaton, Bull Torrey Cl. **6**: 33. 1875.

Illus.: Eaton, Ferns No. Am., pl. 2, f. 1. 1879.

Rare and local on coastal slopes, in clefts of rocks in the Upper Sonoran Zone. In Southern California known only from Slover Mountain! near Colton (Parish, Bot. Gaz. **15**: 51. 1890); near Piru! in Ventura Co. (given as "near Saugus" by Davidson, Cat. Plants of L. A. Co., p. 33. 1896); and in mountains near Santa Barbara! According to Lemmon (Ferns of West, p. 8. 1882) this fern grows only on limestone rocks. Type locality is near Santa Barbara. This species was reported from the Arroya Terquisquite east of Riverside by Reed (Muhlenbergia **5**: 94. 1909).

CHEILANTHES FEEI Moore. Ind. Fil. 38. 1857.

Myriopteris gracilis Fée. *Cheilanthes lanuginosa* Nutt. *Myriopteris lanuginosa* J. Smith.

Illus.: Eaton, Ferns No. Am., pl. 6, f. 1. 1879. Frye & Jackson. Am. Fern Jour. **4**, pl. 17, f. 7–8. 1914. Fée, Gen. Fil. pl. 29, f. 6. 1850–52.

Known in California only from the Providence Mts.!, where it grows in crevices in the canyons at about 4000

ft. (Parish, Bot. Gaz. **65:** 334. 1918 and Munz & Johnston, Bull. Torrey Cl. **49:** 32. 1922). First collected in California by Brandegee and reported as *Notholaena Newberryi* (Zoe **5:** 153. 1903). A collection of *Notholaena Parryi* from San Diego Co. was reported as this species by Maxon (Am. Fern Jour. **8:** 119. 1918) who later corrected the error (op. cit. **10:** 3. 1920).

CHEILANTHES PARISHII Davenp. Bull. Torrey Cl. **8:** 61. 1881.

Illus.: Davenp. l. c., pl. 8.

Known only from about the type locality in Andreas Canyon! at the eastern base of the San Jacinto Mts., where it was discovered by Parish under a cliff in 1881 (Fern Bull. **9:** 73. 1901), re-collected by Saunders in 1908 (Fern Bull. **16:** 35. 1908) and again by Munz (*No. 4696*) in 1921. The Munz collection is a close match for the type, but the Saunders plant is quite atypical, being conspicuously less fibrillose and with smaller more remote segments.

CHEILANTHES FIBRILLOSA Davenp. Bull. Torrey Cl. **12:** 21. 1885.

Known only from the type collection by Parish! made in June 1882 (Fern Bull. **9:** 75. 1901) in the San Jacinto Canyon at Oak Cliff at the point where the road to Strawberry Valley leaves the canyon bed. The plant was found among rocks on a gravelly bench. An unsuccessful search for this fern was made at the type locality by Parish and Johnston in 1918; a similar one by the authors occurred in 1922 when the type locality and the water-shed above were examined.

CHEILANTHES CLEVELANDII D. C. Eaton. Bull. Torrey Cl. **6:** 33. 1875.

Illus.: Eaton, Ferns No. Am., pl. 12, f. 2. 1879.

Frequent in rocky places of the Upper Sonoran Zone, occurring along the foot of the coastal slopes of the

mountains of San Diego Co.!, northward in Riverside Co. where it extends along the western base of the San Jacinto Range to Beaumont! (Parish, Fern Bull. **12:** 7. 1904). It is also reported from Bartletts Canal, Santa Barbara Co. (Maxon, Proc. Biol. Soc. Wash. **31:** 151. 1918). The plants from Santa Cruz Island! reported as *C. myriophylla* by Yates (Bull. Santa Barbara Soc. Nat. Hist. **1:** 10. 1890) and Brandegee (Zoe **1:** 147. 1890) are referable to *C. Clevelandii*, as are also those listed under the former name from Santa Rosa Island (Brandegee, l. c.). Type locality is given as "on a mountain about forty miles from San Diego."

CHEILANTHES COVILLEI Maxon. Proc. Biol. Soc. Wash. **31:** 147–9. 1918.

Bead fern.

Illus.: Eaton, Ferns No. Am., pl. 79, f. 8–15. 1880.

Wide spread and often locally common in rock-crevices or stony ground of the Upper Sonoran and Transition Zones, at elevations of from 2000 to 9000 ft. Over most of the desert area, extending into the mountains forming the coastal divide, and commonly descending the western slopes; present in the Santa Ana Mts.! (*F. M. Reed 3931*), but not occurring in the low hills along the coast. The Schoenfeldt collection referred to by Maxon (l. c.) as from Laguna, Orange Co. is rather to be referred to the Laguna Mts. of San Diego Co. This fern has been current under the names of *C. myriophylla* and *C. Fendleri*, but Maxon (l. c.) has shown that those names apply to extralimital plants.

12. CRYPTOGRAMMA.

CRYPTOGRAMMA ACROSTICHOIDES R. Br. App. Frankl. Jour. 767. 1823.

Parsley fern. American rock brake.

Illus.: Hall, A Yosemite Flora p. 35. 1912. Britton & Brown, Illus. Flora., fig. 74. 1913. Frye & Jackson,

Am. Fern Jour. **4,** pl. 17, f. 9–11. 1914. Eaton, Ferns No. Am., pl. 59, f. 1–5. 1880.

Within our range known from the San Bernardino Mts.! where it is relatively frequent in the Canadian and Hudsonian zones upon the northern slopes of Mts. San Bernardino and the adjacent ridges to the east. Rare on Mt. San Jacinto! only a few plants having been found about the summit (*Munz 6411*). The plant grows in rocky places.

13. ADIANTUM.

A. Blade at least as wide as long, divided into two equal parts. each with several pinnate branches. *A. pedatum* var. *aleuticum.*

AA. Blade much longer than wide, not forked but with a continuous main rachis.

B. Indusia nearly continuous, becoming 8 mm. long; pinnae with more or less rounded, scarcely lobed margin and regular outline. *A. emarginatum.*

BB. Indusia distinct, about 2 mm. long; pinnae wedge shaped, deeply lobed and with irregular outline. *A Capillus-Veneris.*

ADIANTUM PEDATUM L. var. ALEUTICUM Ruprecht.

Beitr. Pflanzenk. Russ. Reich **3:** 49. 1845.

Maiden hair. Five-finger fern.

Illus.: Hall, A Yosemite Flora, p. 28. 1912.

Occasional in our range in moist, shaded rock-crevices in the Upper Sonoran Zone and higher, from 3500 to 8000 ft. alt. We know of the following stations: in San Bernardino Mts. in Snow Canyon! a "Hudsonian Island of Mill Creek Canyon" (Parish, Fl. World **20:** 169. 1917); in the San Gabriel Mts. near Browns Flats! (*Johnston 1445*), in Little Santa Anita Canyon, on Mt. Wilson (Davidson, Cat. Pls. of L. A. Co., p. 33. 1896; and Moxley, Am. Fern Jour. **1:** 104. 1911) and in Eaton Canyon! (*F. W. Peirson 1522*); in Santa Barbara Co. "in the northern portions of the county" (Yates, in Hall-Wood "Santa Barbara County as it is," p. 67.

1884); and on Santa Cruz Island! (Greene, Bull. Cal. Acad. **2:** 415. 1887).

ADIANTUM EMARGINATUM Hook. Sp. Fil. **2:** 39. 1851.
Maiden hair.
Adiantum Jordani C. Mull.
Illus.: Eaton, Ferns No. Am., pl. 38, f. 1–3. 1879.

A characteristic fern of the low coastal hills throughout our range. Common on moist shaded banks and at base of rocks and trees in the Upper Sonoran Zone below 2000 ft. elevation. We have seen specimens from Catalina! (Lyon, Bot. Gaz. **11**: 334. 1886), San Clemente (*Evermann*, Cal. Acad. Herb.), Santa Rosa! and Santa Cruz! (Brandegee, Proc. Cal. Acad. (2) **1**: 205, 218. 1887). In the desert region it has been collected at Palm Springs (Parish, Fern Bull. **12**: 6. 1904) and in the Panamint Mts. (Coville, Contr. U. S. Nat. Herb. **4:** 228. 1893). Known in the literature as *A. Jordani* and *A. emarginatum*, the older of which names we have accepted.

ADIANTUM CAPILLUS-VENERIS L. Sp. Pl. 1096. 1753.
Venus' hair fern. Maiden hair fern.
Illus.: Eaton, Ferns No. Am., pl. 37. 1879.

This inhabitant of calcareous seeps is frequent in the Upper Sonoran Zone of the coastal slopes, where it ascends to about 4000 ft. On the islands it has been collected at Catalina! (McClatchie, Erythea **2:** 77. 1894) and Santa Cruz (Greene, Bull. Cal. Acad. **2:** 415. 1887). The known stations on the desert are Coachella Valley! (*Rixford*, Cal. Acad. Herb.), about Palm Springs!, and in Hanaupah Canyon! in the Panamint Mts. (*Dixon*, U. C. Herb.). A "dichotomously forking and crested" form of this species from Eaton Canyon! in the San Gabriel Mts. has been described by Moxley as forma *cristatum* (Am. Fern Jour. **9:** 27. 1919.)

14. PTERIDIUM.

PTERIDIUM AQUILINUM (L.) Kuhn, var. PUBESCENS Underw. Our native ferns, ed. 6: 9. 1900.

Brake. Bracken.

Illus.: Hall, A Yosemite Flora, p. 30. 1912. Frye & Jackson, Am. Fern Jour. **4**, pl. 19. 1914.

Common as a ground cover on the gentler slopes in the open pine forests, and somewhat less common in wet places. Occurring most abundantly in the Transition Zone, from which it occasionally ascends into the Canadian Zone, as at Tamarack Valley! in the San Jacinto Mts. (*Munz 6035*) where it occurs at 9200 ft. alt. Infrequent in a ranker form in springy places and on stream-banks of the Upper Sonoran Zone and extending even into the valleys, as at Red Hill, Upland! where it has fronds ten ft. long. Throughout our range on the coastal slopes and on Santa Rosa Island. (Brandegee, Proc. Cal. Acad. (2) **1**: 218. 1888) and on Santa Cruz Island (Greene, Bull. Cal. Acad. **2**: 415. 1887).

15. POLYPODIUM.

A. Pinnae usually more than 3 cm. long, and pointed, with serrate margins; plant of less than 4000 ft elevation. *P. californicum.*

AA. Pinnae usually less than 2½ cm. long, rounded at tips, margins entire or crenate, plant of high altitudes. *P. vulgare*, var. *hesperium.*

POLYPODIUM CALIFORNICUM Kaulf. Enum. Fil. 102. 1824.

Rock fern. Californian polypody.

Illus.: Eaton, Ferns No. Am., pl. 31, f. 4–5. 1879.

Common on the coastal drainage, on rocky ledges in the canyons and on moist slopes of the lower hills of the Upper Sonoran Zone, ascending to an elevation of about 4000 ft. Island records are as follows: San Clemente (Lyon, Bot. Gaz. **11:** 335. 1886), Santa Cruz (Greene, Bull. Cal. Acad. **2:** 415. 1887), Catalina!

(Brandegee, Zoe **1:** 115. 1890), and Santa Rosa (Brandegee, Proc. Cal. Acad. (2) **1:** 218. 1888).

A form exhibiting a leathery texture and a greater tendency for fusion of veins, grows mainly in a narrow belt in the immediate vicinity of the ocean and was called by Eaton, var. *Kaulfussii* (Ferns No. Am. **1:** 244. 1879). It is this thick leaved form that is the basis of the numerous reports of *P. Scouleri* from the islands of Southern California, (Parish, Fern Bull. **9:** 40–42. 1901; Yates, Bull. Santa Barb. Soc. Nat. Hist. **1:** 9. 1890; Brandegee, Zoe **1:** 115. 1890; and Trask, Erythea **7:** 142. 1899).

POLYPODIUM VULGARE L., VAR. HESPERIUM (Maxon) Nels. & Macbr. Bot. Gaz. **61:** 30. 1916.

Polypodium hesperium Maxon.

Illus.: Frye & Jackson, Am. Fern Jour. **4:** pl. 20, f. 3–4. 1914.

Known within our limits only from the San Bernardino Mts.!, where it grows in rock crevices in the Hudsonian Zone (Parish, Fern Bull. **9:** 76. 1901 and Pl. World **20:** 169. 1917), and from the San Jacinto Mts.!, where it has been recently collected on the north side of Tahquitz Peak (*Kessler*, Baker Herb.).

II. OPHIOGLOSSACEAE.

KEY TO GENERA.

A. Leaf simple; fertile portion a spike. 16. *Ophioglossum.*

AA. Leaf lobed or divided; fertile portion a panicle. 17. *Botrychium.*

16. OPHIOGLOSSUM.

OPHIOGLOSSUM CALIFORNICUM Prantl. Ber. deutsch, bot. Ges. **1:** 351. 1883.

California adder's tongue.

Illus.: Prantl, Jahrb. kön. bot. Gart. Berlin **3:** 315. pl. 7, f. 11. 1884. E. Britton, Bull. Torrey Cl. **24,** pl. 319, f. 4. 1897.

In Upper Sonoran Zone, in grassy and stony spots on mesas about San Diego! Discovered by Parry at San Diego in 1850, rediscovered by Parry and Cleveland in 1882 (Cleveland, Bull. Torr. Cl. **9:** 55. 1882). Reported as *O. vulgatum* by Davenport (Bull. Torrey Cl. **9:** 71. 1882), as *O. nudicaule* L. f. by McClatchie (Proc. So. Cal. Acad. **1:** 392. 1897), and as *Botrychium nudicaule* by Jones (Bull. Torrey Cl. **9:** 91. 1882) who, reporting it as quite common from Temecula Canyon southward, wrote, "The plant is very inconspicuous, and usually springs up and vanishes in less than six weeks." According to Orcutt, in lit., it is abundant in dry ground on the mesa lands near San Diego and usually associated with *Selaginella* and *Dodecatheon Clevelandi,* sometimes found growing in rocky hollows or near large rocks, but usually most abundant on mesas and in great numbers when present, reaching its best development the last of April and first of May.

17. BOTRYCHIUM.

A. Sterile blade slightly bent over in the bud of the following season, clasping the nearly erect sporophyll. *B. Lunaria.*

AA. Sterile blade and sporophyll both erect in the bud of the following season. *B. simplex.*

BOTRYCHIUM LUNARIA (L.) Swartz. Schrad. Jour. Bot. **2:** 110. 1800.

Moonwort.

Illus.: Britton & Brown, Illus. Flora, fig. 5. 1913.

At present known only from the San Antonio Mts.! where it has been collected only in a single locality in the Upper Transition Zone (Johnston, Pl. World **22:** 78. 1919). Frequent in springy ground near 7000 ft. alt. in the Coldwater Fork of Lytle Creek.

BOTRYCHIUM SIMPLEX E. Hitchc. Am. Jour. Sci. **6:** 103. 1823.

Little Grape-fern.

Illus.: Britton & Brown, Illus. Flora, fig. 4. 1913.

Reported only from the Canadian Zone of the San Bernardino Mts.!, where it occurs sparingly in two localities: Mill Creek Canyon (Robertson, Fern Bull. **15:** 17. 1907 and Parish, Muhlenbergia **3:** 57. 1907) and Big Meadows (Parish, Pl. World **20:** 169. 1917).

It is abundant in the meadows along the South Fork of the Santa Ana River from 7500 to 8500 ft. alt. (*Munz 6164*), growing on slight elevations and about old logs and stumps where there is some drainage.

III. MARSILEACEAE.

KEY TO GENERA.

A. Leaf-blades present; plants hairy. 18. *Marsilea.*
AA. Leaf-blades absent; plants smooth. 19. *Pilularia.*

18. MARSILEA.

MARSILEA VESTITA Hook. & Grev., Icon. Fil. **2,** pl. 159. 1831.

Horse clover.

Marsilea mucronata A. Br.

Illus.: Frye & Jackson, Am. Fern Jour. **4:** pl. 21. f. 1. 1914. Clute, The fern allies, p. 200. 1905. Campbell, Mosses and ferns, p. 417. 1913.

Infrequent on muddy banks of the Upper Sonoran Zone and known only from the following localities within our range: San Diego and Del Mar (Underwood, Zoe **1:** 99. 1890), Ramona! (*K. Brandegee*), Cuyamaca Mts.! (Parish, Fern Bull. **12:** 11. 1904); Thomas Valley in San Jacinto Mts.! (*Munz & Johnston 5446*), near Laguna Beach!, Orange Co. (*Crawford* et. al. Baker Herb.); near Santa Monica (Davidson, Cat. Pls. L. A.

Co., p. 34. 1896), West Riverside! (*Pringle*, U. C. Herb.), near Elsinore! (*Munz 5071*), and near Moreno at the foot of the Jackrabbit Trail! (*Munz & Johnston 5154*).

19. PILULARIA.

PILULARIA AMERICANA A. Br. Monatsb. kön. Akad. Wiss. Berlin 1863: 435. 1863.

Fillwort.

Calamistrum americanum O. Ktze.

Illus.: Clute, The fern allies, p. 206. 1905. Campbell, Mosses and ferns, p. 430. 1913.

Rare and local in our range, in the Upper Sonoran Zone, in heavy soil of bottoms of vernal pools. Known only from mesas of San Diego Co., as at Romona! and San Diego (Parish, Fern Bull. **12:** 11 & 83. 1904); Red Hill!, near Upland in San Bernardino Co. (Parish, Bull. So. Cal. Acad. **16:** 51. 1917 and Bot. Gaz. **65:** 334. 1918); near Elsinore ! (*Munz 5087*) and in Menifee Valley! (*Munz & Johnston 5567*) in Riverside Co.; and near Santa Barbara (Bot. Cal. **2:** 352. 1880).

IV. SALVINIACEAE.

20. AZOLLA.

AZOLLA FILICULOIDES Lam. Encyc. **1:** 343. 1783.

Water fern.

Illus.: Clute, The fern allies, p. 184. 1905. Campbell, Mosses and ferns, p. 416. 1913.

Frequent as a floating plant along sluggish streams, on pools, and on muddy banks in the Upper Sonoran Zone of the coastal drainage; usually below 1000 ft. alt. On the desert known only from Daggett (Coville, Contr. U. S. Nat. Herb. **4:** 227. 1893) whence reported as *A. caroliniana*, but this reference, as apparently all others from Southern California, applies to *A. filiculoides*.

V. ISOETACEAE.

21. ISOETES.

A. Plants normally submerged; spores with low tubercles; plants of high altitudes *I. Bolanderi.*

AA. Plants of ephemeral winter pools; spores smooth; low altitudes. *I. Orcutti.*

ISOETES BOLANDERI Engelm. Parry. Am. Nat. 8: 214. 1874.

Illus.: Clute, The fern allies, p. 228. 1905.

"Formerly in the shallow stream which drained Bear Valley, which is now deeply submerged by the reservoir" (Parish, Pl. World **20:** 171. 1917). In 1918 discovered by H. H. Tracy at Switzers Meadows! growing along a brook that leads into Little Bear Lake (Arrowhead Lake) in the same mountains.

ISOETES ORCUTTII A. A. Eaton, Fern Bull. **8:** 13. 1900.

Illus.: Clute, The fern allies, p. 253. 1905.

Rare and local, known only from winter pools on the mesas near San Diego! (type locality), and near Upland! in San Bernardino Co. Specimens from these localities have been referred by various authors to *I. melanopoda* var. *pallida* (Parish, Bot. Gaz. **65**: 334. 1918 and Bull. So. Cal. Acad. **16:** 51. 1917) and to *I. Nuttallii* (McClatchie, Proc. So. Cal. Acad. **1:** 393. 1897). According to Dr. Norma Ffeiffer, in lit., our plants can be placed in *I. Orcuttii* except certain of Brandegee's San Diego collections which combine some of the characters of *I. Nuttallii.* We feel the agreement in range outweighs the atypical morphological characters and therefore, for the present, place all our material in *I. Orcuttii.*

(To be continued.)

Notes on the Fern Leaf Industry

GUSTAVE THOMMEN

The fern leaf industry constitutes an important item in the business of florists engaged in growing and selling

cut flowers. Maybe what I am going to describe may throw a little light upon the subject of how ferns are handled, before and after storage. I have my information from one of the largest dealers in Boston to whom I went to make sure of it. I have a friend who has been handling the fern department of the above dealer for a good many years, and who knows all the ins and outs of the business. I myself have watched the arrival, unpacking, sorting and selling of those ferns hundreds of times in this firm's store.

I cannot tell you how the men who make a business of collecting ferns work the thing today. Thirty and forty years ago I used to collect hundreds of thousands of ferns for use in the store where I was employed at that time. We went to the woods, where the ferns grew by the million, and simply picked what we wanted, selecting those fronds which suited our purposes best. We filled the left hand until we had 50 or 100. Then we tied the bundle with a string and placed it in a basket which each collector carried along. When the basket was full we called for the boy to take it away and he would leave another basket. The boy took the ferns to the wagon and piled them into empty cases. We always started early in the morning, say six o'clock (October) and had a regular picnic that day, taking things along for making fire and camping out. Next day we packed the ferns away in cold frames, outdoors, and covered them with about three inches of moist moss. When cold weather set in, the frames were covered with glass; later, on top of the glass, boards and, at last, from one to two feet of leaves or hay. Anything to keep out the frost and at the same time keep the ferns as cool as possible. In the winter, when we needed a new supply, we would open the frame and take out sufficient bunches to last us for say, three weeks. These we kept in a dark, moist, cellar or out-house, free from frost.

The commercial collectors do the collecting in a similar manner and store the fronds, in boxes containing about 10,000 fronds, in a cold storage house, at a temperature, as near as possible, of 31 to 32 degrees. When the wholesale or retail florist sends in his order, it is filled from this storage place. The wholesale florist houses rely entirely on the wholesale collectors for their wants. When the goods arrive, in lots of millions, they put them in some city refrigerating establishment and draw from there what they need, from day to day. In these refrigerating places the temperature is also kept at 31 to 32 degrees. All cases that come from the refrigerator have to be opened before the ferns are finally shipped to the retailer. This is absolutely necessary because there is always the possibi ity of finding a great number of fronds spoiled in each bunch. The bunches must be opened and inspected and every spoiled frond thrown out. This loss is always present and some years much more serious than at others. The contents of the cases may also vary considerably. It may happen, as it often does, that there is a loss of from 50 to 75%. The fronds have either shrivelled up, are decayed or only spotted with brown or the whole frond is brown, instead of green. The cause for this has not been properly inquired into or investigated. It seems to me, and to men who have handled ferns for many years, that the fern fronds may have been handled without the necessary care, before being packed into the boxes. They are probably left in big piles, where the chance of heating in the centre may be present. They may also have been subjected to improper temperature, either too much heat, which would cause shrivelling or to frost, which later on would cause decay. Bruising, from stepping on the bundles, would also cause trouble, etc.

The retail florist draws his supply of ferns from the wholesale house in the city as he needs it, either in small

lots, from day to day or week to week. Or he makes a standing contract to have so or so many cases delivered at specified times.

Collecting of ferns starts in July, in the north. New crop ferns from the South come about the beginning of April. These are not stored in the freezer but are sold as soon as they arrive. Collecting lasts until the weather makes it impossible, in the fall. Summer ferns can not be stored for any great length of time and, in fact, the later the fronds are harvested, the better they will stand cold storage.

One New England firm stores about 40 million of Dagger and Fancy ferns every fall. Sometimes the waste is fearful, especially was this last winter an uncommonly bad one. No doubt, a large part or maybe the greatest part of this loss could be prevented by proper caution, but, it seems funny, nobody seems to give this aspect even a thought. All what the dealers will say is: "The fern trade is some speculation, my boy. You make money, if they don't spoil, and you lose a devil of a pile if they do, so what's the use."

I have no positive knowledge, but I believe that the fern collecting and trade is much more important in Chicago than in Boston. Also I believe it is much harder to find supplies of northern grown ferns out West than in the East and especially in New England. Cut ferns always command a third better price out West than they do here and the supply is exhausted a month or two before we begin to get to the bottom of the pile.

BOSTON, MASS.

THE BRACKEN AS A POISONOUS PLANT—Much interest has been aroused among the farmers of Western Oregon by the publication of Professor Wm. E. Lawrence's bulletin on "The Principal Stock-Poisoning Plants of Oregon" (Ore. Ag. Coll. Exp. Sta. Bull. 187, Corvallis,

Jan. 1922). Among the plants belonging to the criminal classes is enumerated the Western form of the common bracken (*Pteridium aquilinum* (L.) Kuhn, var. *pubescens* Underw.). A canvass of the farmers in my neighborhood discloses the fact that the majority had never thought of this fern as anything worse than a great nuisance as an inevitable component of the hay-crop. That it is an abundant and pestiferous weed is evident to the most casual traveller in the Northwest, and societies for its preservation would be about as popular as those in behalf of the diamond-back "rattler;" but that it is also capable of posing as an active poisoning agent has been by no means a matter of general belief. One reason for this may perhaps be found in the fact that stock almost never eat the plant in the green state; the young stalks, however, are esteemed as "greens" by the Indians, and I am informed are extensively eaten in Japan. While many farmers admit cases of poisoning resulting from some component of the hay, there is no agreement as to what it is; some think it is the wild carrot, others some species of vetch, and still others the St. John's wort. No one, however, seems to have undertaken any scientific experiment to isolate the cause of the trouble, and Prof. Lawrence's inclusion of the fern in his list of poisonous plants has met with a very qualified acceptance. The fact of its ability to cause serious physical disorder and even death seems, however, perfectly established by the experiments of Hadwen and Bruce, reported in Dept. of Agric. Canada, Health of Animals Branch Bull. 26 (Ottawa 1917), who by isolating horses and feeding them exclusively on hay containing not less than 20 per cent of bracken, found that after about a month in every case the animal either died or became so weakened that it had to be killed. The toxic principle has not been isolated, but seems to be a fixed oil, insoluble in water, such as is known to be present

in many ferns. That more loss is not caused in a region where the plant is so ubiquitous seems due to the fact that horses will refuse to eat it unless hard-pressed by a shortage of other food. Cattle are apparently not affected. Since it possesses a deep-seated horizontal rootstock, and is surprisingly drought-resistant during our long dry summers, the problem of its eradication is a formidable one, and will perhaps never be solved. In many parts of the Coast Range of Oregon the burnt-over mountain-sides are covered with an almost pure stand of bracken, extending unbroken as far as the eye can reach. It is doubtful if any fern in the Temperate Zone surpasses it in the number of individuals in a given area. In this connection it is interesting to note that although so hardy in other respects, the fronds are very sensitive to cold, and a mere touch of frost suffices to kill them where other vegetation is unscathed. The late frosts of the Middle West would have a very salutary effect in reducing the superabundance of bracken-foliage if they could be imported into our mild trans-Cascadian climate.—J. C. NELSON, SALEM, OREGON.

BOTRYCHIUM OBLIQUUM, VAR. DISSECTUM IN VERMONT. —I have read with much interest the notes on *Botrychium obliquum* var. *dissectum* which have appeared in the JOURNAL of late and I am moved to contribute my mite to the discussion.

I have never found either the species or the variety in any such numbers as Mr. Hopkins mentions on page 115 but rather I have found a few plants in a place here, there and everywhere; usually in an old field where the grass is somewhat run out, or else in an old pasture; in neither case the soil being much wet. Once, in Bethel, Maine, I found both growing on "cradle knolls" in a swale. In this same swale about the borders of other knolls, or hummocks, I collected *Ophiolgossum vulgatum*.

In nearly every case where I have found *dissectum* I have also found *obliquum*. My one exception to this rule was in North West Bethel, Maine, when I was crossing a rich "intervale" with my mind upon other business than botany. I spied a single plant of *dissectum* and, presupposing the presence of *obliquum* near at hand, I hastily posessed myself of the plant and passed on.

My experience agrees with that of Mr. Hopkins in that there are apt to be, and usually are, various graduations between the species and the variety so that it is often difficult to tell which is *obliquum* and which *dissectum*, or some other more or less indistinguishable form.

As to the sterility of *dissectum* I can only say that in most cases my specimens have been well fruited but as to the viability of the spores of course I have no data. If the spores are fertile I see no reason why *dissectum* might not be able to grow by itself.—LESTON A. WHEELER TOWNSEND, VT.

Alluding to my statement in a recent issue of the FERN JOURNAL that the Willoughby Lake station for *Athyrium angustifolium* is the farthest northeast so far reported, Mr. H. Mousley writes, 'I claim Hatley as the farthest northeast point for the species. I have only one station for it however." Hatley, P. Q. is 35 miles north from the Willoughby location and perhaps 5 or 6 miles east.—E. J. WINSLOW.

ADIANTUM PEDATUM. VAR. ALEUTICUM IN NEW ENGLAND.—The annual field meeting of the Vermont Botanical and Bird Clubs was held at Montgomery Center, Vermont, July 10-13, 1922. The town of Montgomery is located in the northwestern part of the state very

Adiantum pedatum and var. aleuticum

near the Canadian line. Five members of the American Fern Society were present at the gathering. The most interesting plant seen was *Adiantum pedatum* L., variety *aleuticum* Ruprecht. A year or two ago Mrs. W. B. Jolley had found this fern growing in territory abounding in asbestos, in Canada, a few miles from the Vermont border. As this plant seemed to her to be different from the ordinary maidenhair she submitted it to a botanical friend who in turn submitted it to Professor Fernald, who identified the fern as *Adiantum pedatum* L., var. *aleuticum* Ruprecht. Professor Fernald suggested that Mrs. Jolley hunt for the fern in Vermont. Accordingly she sought a mountain of asbestos formation and found her fern. The Clubs visited her station, the only one so far known in New England, and found the plant growing in the crevices of the rocks near the entrance to an asbestos mine at an elevation of 2244 feet. The station is on Belvidere mountain in the town of Eden. Among the characteristics of the variety are the blue-green color of the foliage and the usually ascending pinnae. A description of this variety may be found in the issue of Rhodora for November, 1905. In the neighboring town of Westfield at Hazen's Notch *Aspidium Goldianum* Hook. and *Polystichum Braunii* (Spenner) Fée were found in beautiful condition. In Montgomery there is a small station for *Polypodium vulgare* L., variety *cambricum* (L.) Willd. I have a few herbarium specimens of the Adiantum which I shall be glad to send to members of the Society.

HAROLD GODDARD RUGG, Hanover, N. H.

Explanation of Plate 8.—**Fig. 1**, a pinna of *Adiantum pedatum* ×½. Fig 2 a pinnule of the same, natural size Fig. 3, a pinna of var. *aleuticum* ×½. **Fig. 4, pinnule of the variety**, ×1½.

A Fern Society Campaign for Wild Plant Conservation.

R. C. BENEDICT.

With the present number of the Fern Journal there is inserted as a supplement a reprint of the article "Game laws for ferns and wild flowers" from the second issue of the Journal for 1922. In reprinting the article has been slightly revised to allow the insertion of several sub-titles, and there has been added a cover with a new cut of the lady-slipper and pictures of the hart's-tongue and climbing fern.

The purpose of the reprint, as expressed on page 2 of the cover, is to hold up as a possible example for other states the action of Vermont in passing its recent general wild plant conservation law. The plan of the Fern Society is to distribute this reprint as widely as possible throughout the country to a selected mailing list of individuals and organizations likely to be actively interested. A considerable beginning has already been made, and details of the program will be given in later numbers. The following statement has been prepared at the request of the Council of the Fern Society.

For the present it may be noted that we have already had the cooperation of the Brooklyn Botanic Garden through the interest of the Director, Dr. C. Stuart Gager, to the extent of an order for 1,000 copies for distribution to the mailing list of the Botanic Garden "Leaflets," including nearly 800 residents of Brooklyn and Greater New York generally, together with about 200 Agricultural Colleges and Experiment Stations. Later reprinting to the number of 1,500 to 2,500 copies is promised by Mr. P. L. Ricker, of the Washington chapter of the Wild Flower Preservation Society, for wider distribution.

The members of the Fern Society are asked to regard themselves as active members of state and local committees for their respective sections. If you can use additional copies to advantage, these will be sent on application to the writer. If large numbers are needed, try to arrange for a separate new reprinting at local expense. A printer's cost of three to five cents per copy may be counted on, according to the number ordered. Will not Fern Society members try to concentrate effective action in their own states? State campaigns will not necessarily take the same form or seek precisely the same aims. It is hoped, however, that the next few months may see wide-spread interest and activity throughout the country, so that the value of such concerted action may be gained.

The idea of a game law or other means for the protection of wild plants is not entirely a sentimental one, aimed merely to preserve rarities here and there for the pleasures of the initiated. The attitude of mind that is interested in wild things is an important factor in the whole program of conservation of natural resources. To preserve forests for future lumber needs is simply long-sighted business and patriotic sense. To develop an interest in the preservation of the wild through the appeal to the love of wild flowers is one important approach.

We can not claim for our campaign the economic aspects of the campaigns for the protection of wild birds, the feathered allies of man in the war against insects, but we can claim to be marching toward the same goal and, further, that our success will aid in the preservation of the homes of these bird friends.

The cost of reprinting the articles with additional plate and pages has been met by a special appropriation authorized by the Council in October. Included with this was a gift of $25.00 by Mrs. William Spalding, of

Syracuse, a former member of the Society. Out of this total of $75.00 there will be met the cost of the Society's supply of 1,700 reprints, some of the postage, the cost of the new plate, and additional items which will be reported in detail later.

The Council asks the aid of the members at large, not only in furthering the campaign of education, which it is hoped may be accomplished by the distribution of the reprint, but also by such cash contributions as may be possible toward the special printing fund, to the end that the Society's reserve for regular printing may be restored. If one-sixth of our three hundred members should send a dollar apiece to the Treasurer, the fifty dollar fund would be completely restored.

American Fern Society

Our Curator, Prof. L. S. Hopkins, is now settled at his new place of residence, Canton. Mo., where he is Dean of Culver-Stockton College. He wishes it announced that requests for the loan of specimens from the Society Herbarium should be sent to him at the above address and that he will now be able to give them immediate attention.

Through the kindness of Mrs. C. A. Weatherby, who has made the drawing, we are able to present the plate of *Adiantum pedatum*, var. *aleuticum* which accompanies Mr. Rugg's note on the finding of this plant in Vermont by Mrs. Frances L. Jolley—one of the most interesting discoveries made in the eastern United States in recent years. The drawing of var. *aleuticum* was made from one of Mrs. Jolley's specimens; that of typical *A. pedatum* from a specimen collected at Bolton, Conn.

With this number, volume 12 of the JOURNAL is completed: our readers may be interested in an account

of some of the prospects for the next volume. Miss Marshall has sent us an interesting, illustrated account of a peculiar form of the ebony spleenwort, growing in a most unexpected place, which has been under observation by her and by others for a number of years. There is probably no genus of fernworts which gives more trouble to amateurs and even to expert botanists in determining species than does the genus *Equisetum*: Prof. J. H. Schaffner, who has made a special study of the genus, has prepared a key for the use of amateurs with the especial object of pointing out the important characters which are to be depended upon in naming specimens. We also hope to begin at an early date a series of illustrated articles on single species of ferns, in which, through the collaboration of several members, an effort will be made to bring together all available information to date in regard to the characters, habits, distribution, etc., of the plants concerned, and to present it in an interesting and untechnical manner. Another prospect is an article on tropical species desirable for cultivation, but not now on the market.

The Judge of Elections, J. C. Nelson, Salem, Oregon, reports the election of the following officers for 1923:—President, W. R. Maxon; Vice-President, Miss M. A. Marshall; Secretary, Rev. C. S. Lewis; Treasurer, J. G. Underwood. The nominating committee consisted of C. H. Bissell, Chairman, Miss Annie Lorenz and Bayard Long.

New Members:—

Kittredge, Miss E. M., Proctor, Vt.

Taylor, Norman, Brooklyn Botanic Garden, Brooklyn, N. Y.

Whitman, Mrs. William, Jr., 17 Common-wealth Ave., Boston, Mass.

Change of address:—

Greene, F. C., 1434 South Cincinnati Ave., Tulsa, Okla.

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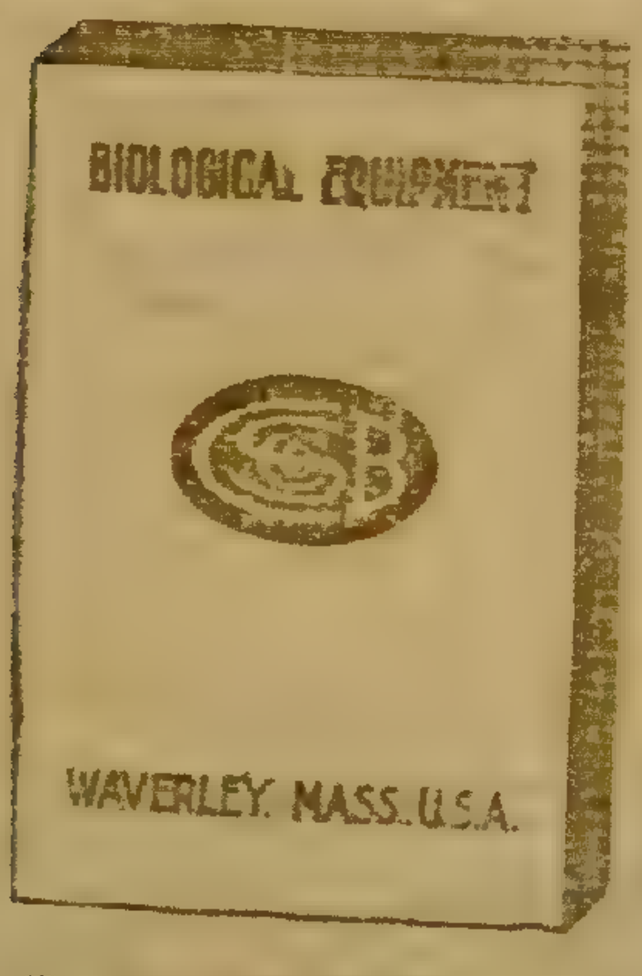

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American Fern Journal

Vol. 13 JANUARY–MARCH, 1923 No. 1

The Distribution of Southern California Pteridophytes.

PHILIP A. MUNTZ AND IVAN M. JOHNSTON[1]

VI. SELAGINELLACEAE.

22. SELAGINELLA.

A. Stems erect or ascending, several inches long. *S. Bigelovii.*

AA. Stems creeping and prostrate.

B. Branches strongly flattened, bright green above and pale below; leaves not setose; plant of lax habit; Colo. Desert. *S. eremophila.*

BB. Branches terete, not flattened, without definite upper and lower surfaces; color uniform above and below.

C. Setae yellowish, rather short; plant bright yellowish green; of high altitudes. *S. Watsoni.*

CC. Setae, if present, not yellowish, but white; plant pale green.

D. Setae slender, ⅓ to ½ as long as leaves; plants of high mountains. *S. asprella.*

DD. Setae stout or none, evidently less than ⅓ the length of the leaves.

E. Setae none; stems wiry, several cm. long, forming a carpet-like growth very close to the ground; low altitudes of San Diego region. *S. cinerascens.*

EE. Setae very short, white and opaque; stems short, 3–4 cm. long, very crowded, forming cushion-like masses; eastern part of the Mohave Desert. *S. leucobryoides.*

SELAGINELLA BIGELOVII Underw. Bull. Torrey Cl. 25: 130. 1898.

Illus.: Clute, The fern allies, p. 144. 1905.

Very common throughout the coastal area, in dry rocky soil of the slopes and washes of the Upper Sonoran

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[1] Continued from Vol. 12, page 122.

[Vol. 12, no, 4 of the JOURNAL, pages 101-139, plate 8, was issued Dec. 30, 1922.]

Zone, occasionally ascending to 6000 ft. alt. Reaching the edge of the desert as about Palm Springs! where exceedingly common in the canyons, and Campo! (*Eastwood 9451*). Known also from San Clemente Island! (*Evermann*, Cal. Acad. Herb.), Santa Catalina! (*Eastwood*, Cal. Acad. Herb.) and Santa Cruz Island! (*Eastwood 6391* and *Brandegee*, Dudley Herb.). Most Southern California references to *S. rupestris* refer to this species.

SELAGINELLA EREMOPHILA Maxon, Smithson. Mis. Coll. **72**: 3. 1920.

Illus.: Maxon, l. c., pl. 2.

Not uncommon in Colorado Desert. Forming mats in sheltered places among rocks and on ledges of the low Upper Sonoran Zone and high Lower Sonoran Zone, reaching an altitude of 3000 ft. Extending from the region of Palm Springs! (the type locality) southward along the western edge of the desert to Mountain Springs! (Maxon, l. c.). To the east known only from Chuckawalla Mts.! (*Munz & Keck 4865*). This species has been known as *S. Parishii*, a name which Maxon (l. c.) has lately restricted to a Mexican species.

SELAGINELLA ASPRELLA Maxon, Smithson. Mis. Col. **72**: 6. 1920.

Illus.: Maxon, l. c., pl. 4.

Locally frequent, forming mats on rocky ground with sunny exposure, in the higher mountains from the Upper Sonoran Zone! (Cactus Flats, San Bernardino Mts., *Munz 5745*) to the Canadian. Known from the San Gabriel Mts.! (*Johnston 1815* and *1595*), San Bernardino Mts.! (*Munz 6300* and Maxon, Am. Fern Jour. **11**: 107. 1922), and San Jacinto Mts.! (*Jaeger 276*). This species has long been confused with *S. Watsoni* in Southern California references. The type locality is on "west end of Ontario Peak," San Gabriel Mts.

SELAGINELLA WATSONI Underw. Bull. Torrey Cl. **25:** 127. 1898.

Illus.: Clute, The fern allies, p. 144. 1905.

Locally frequent in rocky places of northern exposure in the Upper Transition, Canadian, and Hudsonian Zones. Especially abundant on the northern slopes of Mt. San Gorgonio from 8500 ft. (*Munz 6192*) to the summit (*Munz 6206*). Other collections are from the San Bernardino Mts.! (*Grinnell*, Baker Herb., *Abrams & McGregor 700*, *Parish 5052*, *Munz 6303*), San Jacinto Mts.! (*Jaeger 290*, *Reed 2466*, *Munz 6045*), and Santa Rosa Mts.! (*Munz 5869*). Altitudinally the lower part of its range overlaps the upper part of that of *S. asprella*, but even when in the same canyon with this species it is found on the cooler shaded slopes.

SELAGINELLA CINERASCENS A. A. Eaton, Fern Bull. **7:** 33. 1899.

Lycopodium bryoides Nutt. *Selaginella bryoides* (Nutt.) Underw.

Illus.: Clute, The fern allies, p. 146. 1905.

Common on clay soil of the mesas in the Upper Sonoran Zone of southern coastal San Diego County! Forming close appressed mats composed of very wiry prostrate stems (Parish, Bull. So. Cal. Acad. **14:** 12. 1915). Type locality, National City near San Diego. First described as *Lycopodium bryoides* but Nuttall's specific name is preoccupied under *Selaginella* and Eaton's much later name must be accepted (Underwood, Fern Bull. **10:** 9–10, 1902).

SELAGINELLA LEUCOBRYOIDES Maxon, Smithson. Mis. Col. **72:** 8. 1920.

Illus.: Maxon, l. c. pl. 5.

Known only from the Providence Mts.! where it forms mats on dry rocky hillsides of the Upper Sonoran Zone, at from 3000 to 4500 ft. alt., and from the Pana-

mint Mts. Type locality is near the Bonanza King Mine of the Providence Mts.

VII. EQUISETACEAE.

23. EQUISETUM.

A. Stems all green and seldom branched; stomates in regular rows.
  B. Sheaths dilated upward, all but the lowest green with narrow black margin. *E. Funstoni.*
  BB. Sheaths not dilated upward but tight to the stem, mostly with two black bands separated by an ashy one. *E. hiemale* var. *robustum.*

AA. Stems of two kinds, the green ones usually sterile with whorls of branches at each node, the fertile ones pale brown and not branched; stomates scattered.
  B. Sterile branches stout, generally over 3 mm. in diameter and 6–12 dm. high; sheaths 20–30 toothed. *E. Telmateia.*
  BB. Sterile stems slender, generally less than 3 mm. in diameter and less than 6 dm. high; sheaths with about 12 teeth. *E. arvense.*

EQUISETUM FUNSTONI A. A. Eaton, Fern Bull. **11:** 10. 1903.

Scouring rush.

Illus.: Clute, The fern allies, p. 34–35. 1905.

The common *Equisetum* of Southern California. In wet ground at low altitudes throughout the coastal part of our range; generally in the Upper Sonoran Zone, but occasionally reaching Upper Transition Zone! (*Johnston 1723* from 6500 ft. alt.) On the desert it has been collected at Whitewater, Palm Springs, Camp Cady, Victorville!, and the Panamint Mts. (Parish, Fern Bull. **12:** 12. 1904). Eaton has described four growth forms of this species, all of which are found in our range: the most common being f. *nudum*, one to two ft. high, erect and unbranched; and f. *caespitosum*, lower and diffusely branched. This species has passed under a variety of names: *E. variegatum*, *E. laevigatum*, *E. robustum*, and

E. mexicanum. We agree with Parish (Fern Bull. **9**: 73. 1901) in doubting the occurrence of the exotic *ramosissimum* on Mt. Wilson for the same reason that Eaton (Fern Bulletin **11**: 10. 1903) doubted its occurrence in British Columbia: (1) it has not been reported again since the collection by Davidson much over 20 years ago, (2) it is the only known station in the United States and is far removed from any authentic station, (3) *E. Funstoni* is very variable and some form of it might easily be taken for *E. ramosissimum*.

Under *E. Funstoni* we group all our local plants referred by Schaffner (Am. Fern Jour. **11**: 65–75. 1921) to *E. kansanum*, *E. Funstoni*, and *E. laevigatum*, and keyed out by him as follows:

I. "Cones tipped with a rigid point, the termination of the floral axis; aerial stems evergreen" *E. laevigatum*.

II. "Cones rounded at the top or merely acute, not with a rigid point; aerial stems annual, not surviving the winter in regions of frost."

a. "Not with numerous branched basal sterile shoots around the fertile shoots; stems very smooth, with cross bands of silex; limb of the long green sheath dilated upward, with a narrow black band at the top, not incurved." *E. kansanum*.

b. "With a cluster or rosette of small, branched, sterile shoots around the base of the fertile shoots; stems very rough with cross bands of silex; limb of the rather short sheath strongly incurved with age, with a narrow black band at the top; stomata often in two rows." *E. Funstoni*.

The characters used by him to separate *E. kansanum* and *E. Funstoni* do not seem to hold when applied to a series of specimens. Since we do not find the characters positive, and do not find them inhabiting ranges distinct enough for "species" so closely related (such species would swamp by hybridization) and since we are not satisfied that such differences are not ecological in origin, we do not recognize these as distinct species. Furthermore we are not at all satisfied as to the relationship

of *E. Funstoni* to *E. laevigatum*. In Schaffner's key these species are widely separated by the division into groups according to whether or not the cone is tipped by a rigid point, but the difference between the species is not as great as this division might suggest, for many plants are intermediate in this development. *E. Funstoni* is so close to *E. laevigatum* that we hesitate to recognize it as distinct from the eastern *laevigatum*; however, before reducing it to synonymy we feel the need of more field work and hope that this may soon be carried on and the true condition discovered.

EQUISETUM HYEMALE L., VAR. ROBUSTUM (A. Br.) A. A. Eaton, Fern Bull. **11**: 74. 1903

Giant scouring rush.

Equisetum robustum A. Br. *Equisetum prealtum* Raf.

Illus.: Clute, The fern allies, p. 26. 1905.

Occasional in colonies on stream-banks in canyons of the lower chaparral belt on the coastal slope, at altitudes below 4000 ft. It has been said to be "not rare" in the southern part of the state (Parish, Fern Bull. **12:** 13. 1904), but we have seen no material south of the San Gabriel! and San Jacinto Mts.! In the deserts reported from the Panamint Mts. (Coville, Contr. U. S. Nat. Herb. **4:** 226. 1893). There is a report of its occurrence on Catalina Island (Davidson, Erythea **2:** 30. 1894). We do not feel that this form is distinct from *E. hiemale* and cannot follow Schaffner in so treating it (Am. Fern Jour. **11:** 71. 1921). The two forms are similar in habitat and appearance, the only difference being whether or not tubercles on the ridges are in one or two rows; but that character is not constant and is indicative of a variety rather than a species.

EQUISETUM TELMATEIA Ehrh. Hannov. Mag. 138. 1783.

Giant horse tail.

Illus.: Frye & Jackson, Am. Fern Jour. **3,** pl. 4, f. 5–6. 1913. Clute, The fern allies, p. 50. 1905.

Occasional in the coastal drainage at elevations below 3000 ft., where it grows along borders of swamps and streams from San Bernardino and Los Angeles northward. A single collection has been seen from the edge of the desert in San Felipe Canyon! in San Diego Co. (*Palmer 421*). Eaton (Fern Bull. **8:** 76. 1900) reports it from as far south as San Diego. Known also from Santa Cruz Island! (Brandegee, Proc. Cal. Acad. (2) **1:** 205. 1888) and Catalina Island (Eaton, Fern Bull. **8:** 76. 1900). A specimen of the form described as *E. Telmateia* var. *serotinum* A. Br. has been collected near Glendale! (Davidson Herb.); it is distinguished by the presence of cones on the branched and normally sterile stems.

EQUISETUM ARVENSE L. Sp. Pl. 1061. 1753

Common horsetail.

Illus.: Britton & Brown, Illus. Flora, f. 89. 1913. Frye & Jackson, Am. Fern Jour. **3,** pl. 4, f. 8–10. 1913. Clute, The fern allies, p. 44. 1905.

For our range known only from the following stations: San Bernardino Mts.! (Parish, Pl. World **20:** 170. 1917), San Bernardino Valley! (*Parish 4052 & 4075*), Victorville! (*Parish 10553*), San Jacinto Canyon! (*Street & Durant*, Baker Herb.), Los Angeles River bed! (*Moxley 509*), Nichols Canyon! Santa Monica Mts. (Davidson Herb.); Ojai (Parish, Fern Bull. **12:** 12. 1904), Hopper Canyon near Piru! Ventura Co. (Davidson Herb.).

Proliferous Ebony Spleenwort

M. A. MARSHALL

Easter of 1916 found me making my first visit to my friends at Woodstock Academy, Woodstock, Conn. The table decoration was a pot of *Asplenium platyneuron*, which my hostess said came from the basement, where

there was a fine bed of it. It was her custom to select a pretty specimen, use it until it began to be shabby, then replace it in its original station and get a fresh plant. I was interested, but my visit was very short and fully occupied, and I made no effort to see the ferns in place. In February of the next year I was again at the Academy, this time for a longer stay, and as before a little Asplenium adorned the table. This time its appearance was not quite normal and I took the pot in hand for closer examination. The scrutiny was well repaid. The sterile fronds had pinnae proportionally broad, rounded at the ends, rather deeply round-scalloped, ruffled to the midveins, and so thickly set on the rachis as to overlap; and several stipes bore little plants near the base. This was indeed a novelty and I made haste to explore.

I found that the Academy building had been set directly on a ledge, with little excavation except at the west end, where were the furnace and a large water tank supplied with rain water from the roof through a pipe running the whole length of the basement from east to west and at that time having many small leaks. In no place beyond the furnace and tank was there room to stand up, but the rather painful trip was rewarded by finding at the east end, where were four horizontally two-light windows, one north, two east and one south, a beautiful bed of the ferns sought. There were also two or three plants of some large fern, the fronds dry, brown, and completely curled up, a square yard or so of a small fern without green fronds, the rootstocks of which showed above the soil, and a little bed of English violets beginning to grow and show buds. The dormant ferns later proved to be *Asplenium Filix-foemina* and *Cystopteris fragilis* respectively. No measurements were taken, but in my judgment not less than four or five square yards of ground were more or less thickly

set with Asplenium plants, of varying sizes but good color and texture. It was the fruiting season and of seventy-five mature and fruited plants examined twenty-five by actual count bore the little plants near the bases of the stalks. Several of the plants before the north window had large and thrifty plantlets on stipes so old that they had dropped all their pinnae and were perhaps half broken off. Enough material for four or five sheets was collected. The largest plant of the collection had one well fruited frond fourteen and three fourths inches long and one and a fourth inches wide; another was thirteen inches long. No thought was given to that matter at the time, but in examining the dried material since I find the proliferation on sterile fronds only.

Now began the hunt for the origin and history of the basement fern, which was known to all the neighborhood. One woman said Miss Allen, a former teacher, planted it. Miss Allen's address being given, she was appealed to, only to get the information that she did not plant the fern but had been interested in it and had planted more seed of the violets she had found there. During eight years of knowledge of the school as pupil and teacher she had never seen the species growing outside the school. Another lady with a lifelong knowledge of the school said the species was not uncommon in the neighborhood and suggested that a colony of it might have been on the ledge when the building was erected. Mrs. Hall, wife of a former principal, said the ferns were growing in the basement when she went there in 1888. They had multiplied since then.

From Woodstock in February of 1917 I went to New York where I took the opportunity of visiting the herbarium of the New York Botanical Garden. There I found one sheet containing two or three fragments consisting mostly of naked stems bearing good sized young plants near their base and labeled "A. *platy-*

Proliferous Ebony Spleenwort

(Photograph by G. W. Fornell)

Note the young plants on the stipes at the upper right and the left-hand portions of the picture.

neuron—proliferum. Dr. C. E. Waters, McCall's Ferry, York Co., Pa., July 6, 1904." Enough of my material for a good sheet was left there and should be found by any one interested.

In June of the same year I was again in Woodstock for a short stay. Of course the basement was visited. The ferns were found to be in their resting season; some were dead and others were dying. I wondered whether the fact that the leaks in the water pipe and some breaks in the wall had been repaired had any bearing on the case. The Cystopteris was in luxuriant growth and full fruit, the fronds being almost translucent and so lax that they lay prone, making a beautiful carpet on the ground they occupied. Some material of this species was now collected, also another plant or two of the Asplenium, one bearing two fronds tufted at the ends. In February a live plant had been sent to Mr. E. J. Winslow and another to Mr. H. G. Rugg of Hanover, N. H., who reports that he set it in his outdoor fern garden where it did not survive the first winter.

My friends left Woodstock in January of 1918 and several inquiries about the basement fern addressed to the principal of the Academy remained unanswered. I had given up the hope of learning anything more when, at the Fern Society meeting in Boston, September 24, 1921, talking about it with Mr. C. A. Weatherby, he undertook to visit Woodstock and see for himself what was the condition of the fern colony. Under date of September 30, Mr. Weatherby reported exploring the basement in company with Mrs. Weatherby and Miss Upham of the Academy faculty.

"We found ferns growing in front of two of the basement windows—those nearest the northeast corner of the building and facing east and north respectively. By the former was one comparatively gigantic plant of lady fern, bearing three fronds a foot or more long; four or five small

specimens of fragile bladder fern; and one small and struggling plant of ebony spleenwort. There were also the skeletons of several deceased plants of the latter which had evidently been fairly vigorous and had borne numerous fronds in their time, and a fine growth of fern prothallia, covering the ground with a green carpet over an area of, I should suppose, a couple of square feet. It may be that some of these green things were young plants of *Marchantia* or *Conocephalus;* but the presence of tiny young fern fronds here and there showed that a good proportion of them were fern prothallia.

"In front of the north window was another, smaller, plant of lady fern and seven or eight plants of the spleenwort. There was no *Cystopteris* here. The spleenworts were all rather small and had only two or three fronds apiece, all sterile, but seemed healthy otherwise. The pinnae were mostly of the short, obtuse type found at the base of fertile fronds in normal plants and they tended to be rather deeply crenate. I could find no evidence of proliferation such as you observed. There was a good growth of prothallia here too, though not so many as at the other window.

"The soil in the basement was moist, even after the dry weather we have had; neither the fronds nor prothallia were at all withered. At this northeast corner the ground outside slopes a little upward from the building; it seems to me that water finds its way under the foundation wall, in little crevices and irregularities of the native rock, and is drawn to the surface inside by capillary attraction. Since there is little evaporation in a basement, it supplies the moisture the ferns require for existence, and the windows give sufficient light. I do not see how spores could get in as long as the windows are kept closed; but if they are sometimes opened, or removed for cleaning or painting, or if an opening was made in the wall in the course of repairs, fern spores might blow in."

Under date of March 7, 1922, Miss Upham reported having visited the fern colony in the basement that day, finding ten Asplenium plants, none large and none fertile, but one frond bearing a tiny plant on its stalk. There were also many prothallia, some of them developing fronds. It seems to be the general opinion among those most familiar with the circumstances that the Asplenium has been growing in its present situation since before the erection of the present Academy building, some fifty years ago. Miss Upham has examined several colonies of *Asplenium platyneuron* outside the school building and finds no trace of proliferation.

Both Mr. Weatherby and Mr. F. G. Floyd have kindly looked for references to this variety of Asplenium and find that in Rhodora V, 272, 273 and VI, 210, Dr. Waters notes finding the form which he says was described by Eaton. The reference follows:

"*Asplenium ebeneum*, var. *proliferum*.—Rachis proliferous near the base of the frond. Many tropical Asplenia are known to be proliferous, but with the exception of *A. ebenoides* proliferous forms have not been hitherto noticed in the United States. Capt. Smith collected a few specimens of *A. ebeneum* near Ocala, Fla.; and, looking at them closely, I find as many as three fronds with proliferous buds on the rachis just by the lowest pinnae. One frond has three such buds, and from them young fronds one or two inches long have been produced. I find one frond, which I collected many years ago in Florida, similarly proliferous, though the young fronds have not shown themselves.—D. C. Eaton in Bull. Torrey Botanical Club VI, 307 (1878)."

Who can tell the cause of this curious variation from the type?

STILL RIVER, MASS.

Recent Fern Literature.

Prof. M. L. Fernald[1] has published a detailed study of the group of *Polypodium vulgare* in North America. His conclusions are:—

1. That the common polypody of northeastern North America is not identical with the original *P. vulgare* of Europe, but is a distinct species, which was long ago named *P. virginianum* by Linnaeus, and which is found also in parts of eastern Asia.

2. That the plants of the Rocky Mountains and the Pacific slope, known as *P. californicum*, *P. falcatum*, and *P. hesperium*, are so like true *P. vulgare* of Europe that they cannot be separated from it except as varieties.

We are so used to regarding our eastern polypody as *P. vulgare* that such conclusions may, as Prof. Fernald hints, seem to many of us almost revolutionary. Nevertheless—and aside from the new evidence which his close study of the plants themselves has brought out—they are exactly parallel to those arrived at by Prof. Butters in a similar study of the lady ferns,[2] and in entire conformity with certain facts of plant distribution which are becoming more and more familiar—the facts, namely, that plants of eastern North America tend to differ from those of Europe and to be like those of eastern Asia, and that plants of western North America tend to be like those of Europe and unlike those of eastern Asia. As in the case of the lady ferns, also, the differences between the east American and European polypodies have been, in part, noted by earlier authors, notably Hooker, Torrey and Kunze.

For the convenience of our readers, the main characters by which Prof. Fernald separates *P. vulgare* and *P. virginianum* are here set down.

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[1] Fernald, M. L. Polypodium virginianum and P. vulgare. Rhodora **24**: 125–142. Sept., 1922.

[2] See Rhodora **19**: 169–202, 1917 and this Journal **8**: 53–55, 1918.

P. vulgare	*P. virginianum*
Rootstock firm, sweet.	Rootstock rather soft and spongy, not sweet.
Scales of rootstock uniformly colored (or darker toward the base), densely cellular, with thin cell-walls, peltately attached, 0.5–1 cm. long.	Scales of rootstock darkened on the back, loosely cellular, with thick cell-walls, cordate at base (the sinus often with overlapping sides), 2–4.5 mm. long.
Lowest pinnae commonly shorter than the middle ones, the latter with midribs commonly curved at base.	Lowest pinnae usually as long as, or longer than, the middle ones, the latter with straight midribs.
Sori about halfway between midrib and margin.	Sori distinctly nearer the margin than the midrib.

In addition, Prof. Fernald notes that the North American plant is, as anyone who has hunted for varieties of it knows, for the most part remarkably uniform, while the behavior of the European is well described by the classic couplet:—

"Oh, how wondrously you vary,
Polypodium vulgare."

Except in the tropics, ferns do not often become naturalized in regions where they are not native. It is, therefore, of especial interest to find Mr. J. G. Scott recording, in the *American Botanist*, the spontaneous appearance of an Asiatic fern in Pennsylvania. In what he describes as "the enchanted wild garden on the Pilling premises" in Germantown, specimens of *Polystichum Standishii* (or *Aspidium laserpitiifolium*), apparently thoroughly established, have been found.

Mr. Scott does not venture on any conjectures as to how they came there. *Polystichum Standishii* is not common in cultivation in this country. Its native range is from Japan to Tonkin; plants of it from Japanese sources might be expected to prove more or less hardy

in the latitude of Philadelphia, if they once became established.[1]

Under the title "The Group of *Polypodium lanceolatum* in North America," Contr. Gray Herb., New Series LXV, pp. 3–14 (1922), Mr. Weatherby has discussed a group of seven tropical species of *Polypodium*, all with simple leaves and net-veined like the common Florida *P. aureum*. The article represents a careful discrimination among a group of confused forms and includes a key based on gross and detailed characteristics together with descriptions and citation of synonymy and distribution, and specimens under each of the species. Four new species are described: *P. erythrolepis*, *P. Conzattii*, *P. fructuosum*, and *P. panamense*, and several new varieties.

"Why not take ferns as a Hobby?" The question is quoted from the cover page of the May issue of the "Nature Study Review," where it stands as a caption under a picture of a plant of Christmas fern. In the body of the issue, as one hobby among several, Miss Amey Lillibridge, one of our Fern Society members, has a short article covering her pleasure in the pursuit of ferns as a hobby.

The ferns of Mississippi are considered in a Bulletin of the Mississippi State Geological Survey No. 17 (1921) under the general title of "The Plants of Mississippi." The volume is a catalogue of the flowering plants and ferns of the state in which the distribution of each species is given with its name and with reference where possible to the herbarium of the Geological Survey. Thirty-five species of ferns, horsetails and lycopods are

[1] Scott, J. G. *Aspidium laserpitiifolium* in Pennsylvania. Am. Botanist 28: 112–114, fig. 1. Aug., 1922.

included. The number will probably be raised in the course of further investigation.

WALL FERNS IN WILMINGTON, NORTH CAROLINA.—How the huguenot fern, *Pteris multifida* Poiret, has in recent years been spreading on walls in various southern cities is well known,[1] but it does not appear to have been recorded heretofore that it has reached Wilmington, N. C. However, in June, 1922, it was found by Mr. Harry W. Trudell and the writer to occur there in abundance, perhaps the most luxuriant colony being on a stone and brick wall in the storage yard of the city water department, about four blocks south of the center of the city.

In an alley opposite the Post Office a few plants of this fern were noted, but with them were a considerable

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[1] Bragg, L. M. Bull. Charleston Mus., **10**: 19, 1914; Am. Fern Jour **4**: 87; Small, J. K. Jour. N. Y. Bot. Garden, **21**: 175, 1920.

number of another species, the Venus-hair fern, *Adiantum Capillus-Veneris* L. This may also represent an escape from cultivation, but as the species is known to grow naturally on the bluffs of the Cape Fear River a few miles below the city, it is not unreasonable to assume that the spores have reached the wall from native sources.

The "soil" into which the roots of these ferns extend is of course largely made up of the calcium carbonate and sand of the mortar, and is decidedly alkaline in reaction, so that these species are evidently to be classed as preferring alkaline soils. They thus represent exceptions to the rule that southern species, when pushing northward, are inclined to favor acid conditions.[2] The accompanying figure illustrates the occurrence of *Pteris multifida* as a wall fern.—EDGAR T. WHERRY, *Washington, D. C.*

The Progress of the Fern Society Program for Wild Plant Protection.

The progress of the Society's program for wild plant protection is best indicated by some of the comments it has evoked. Here are excerpts from a few letters in regard to the "Game Laws" reprint.

"There is much need of a well sustained movement to preserve our vegetation. The great difficulty is to reach the vandals. These vandals are mostly thoughtless people who live for the present and never read any article or books about plants and have no particular thought or care for the out-of-doors. When the weather is physically agreeable they go out and pull up armfuls of things that appeal to the eye and throw them away as soon as they wilt."

"I wish a movement of rather large scope might be organized, having behind it the cooperation of a good

[2] Am. Fern Jour. 11: 15, 1921.

number of national societies to the end that a real campaign, with publicity in the newspapers, might be put on every spring. The subject ought to be brought to the attention of persons who ordinarily would never read a thing about such subjects." (From Prof. Liberty Hyde Bailey of Ithaca, N. Y.)

"I especially appreciate the article on "Game Laws for Wild Flowers" because I live in the country which is infested by Sunday automobilists who tear up everything on property which is not guarded against trespassing." (Prof. M. A. Bigelow, Columbia University.)

"I think your pamphlet entitled, "Game laws for ferns and wild flowers" is an admirable document and calculated to make a lasting impression. It is high time that the protection of eastern wild flowers including the blossoms of laurel, dog-wood, and azalea should be taken up seriously and urged in all the legislatures this side of Indianapolis. In the mid-western states the need is not so great. Here in the congested east around the big cities the need is very great, and nowhere is legislation more needed than in the area bounded by Washington, Pittsburg, Cleveland, Augusta, Me., and the Atlantic coast.

"I think it would be an excellent thing to send a pamphlet to individual members of all conservation commissions and all state game wardens within that area. . . . Unquestionably there are enough botanists in the east to make a powerful drive on this subject, if they will only take it up seriously and do it systematically. The wild life conservationists have been toiling in the vineyard for years and sometimes sweating blood. They are already so heavily burdened that this work will not be taken up except by new people with new resources.

"It would be an excellent plan to send a copy of this pamphlet to each member of the state legislatures of

Pennsylvania, New Jersey, Delaware, Maryland, New York, Connecticut, Rhode Island and Massachusetts. I sincerely hope you will push this campaign vigorously and never let up until you have secured the laws that you think ought to be passed. I think you have turned out an admirable and highly useful publication and I hope it will receive a circulation of at least twenty thousand copies." (Dr. W. T. Hornaday, Director, New York Zoological Society.)

The following query was later brought to Dr. Hornaday's attention and his reply is given below.

"There is an interesting question as to the content of a possible protective law, say for New York State, relating to rare plants. Upon what basis can these be forbidden trade distribution? They do not seem to class with types of protected animals like game birds and insect eaters. Possibly they may have the same claim, partly sentimental, as that of the Bald eagle, assuming that protection for this bird is based upon sentiment more than upon its utilitarian character." To this Dr. Hornaday replied:

"Beyond question it is entirely right and proper for the legislature of the State of New York to enact a law for the protection of plants and trees because of their beauty, just as it enacts laws for the preservation of scenery and historic places. A great many birds are protected regardless of their industrial and economic value to man, and some are protected which many men claim are positively harmful. . . .

"The way to obtain a law for the protection of beautiful wild flowers and shrubbery is to demand it and to demonstrate that it will be an injury to the people of the state not to grant it."

Dr. Homer D. House, State Botanist of New York, who has given particularly careful study to the possibilities of legal protection for plants, writes in a vein

similar to Dr. Hornaday. "If in the future any law resembling the Vermont law is passed, it should be made, in my opinion, a chapter of the Conservation Law, which is possible if the Conservation Committee of the legislature can be shown that wild flowers and ferns of certain sorts are essential to the general welfare of the public, and that their destruction is injurious to the balance of nature, recreational value of the country and constitutes needless vandalism." Dr. House believes, however, that the first step in a legal way should be the "putting in an amendment to the Conservation law which would protect any plants on State land designated by the Commissioner for protection by the Commission's protectors, State Troopers, and any other agency designated by law to enforce the Conservation law."

"We have been trying for the last few years to get the state to set aside a number of interesting regions in Ohio to be designated as public parks and monuments, but so far nothing has come of it except that some tracts have been set aside as state forests. It is these regions where I think the most could be done to preserve wild life, including flowers and interesting plants." (Prof. John H. Schaffner, of Ohio State University.)

"Lovers of rare wood plants and ferns will welcome the suggestion of "game laws" for plants similar to those which now forbid the hunter and fisherman from despoiling the forests and streams of their animal inhabitants." So begins an editorial from the New York Tribune of Dec. 19, 1922, and continues for a half colume of discussion with data derived from the Fern Journal article. The Boston Post reprinted the Tribune editorial, and the Cleveland Plain Dealer gave expression to similar sentiments. Other articles advocating some sort of plant game laws have appeared or are in press in Science by Dr. C. Stuart Gager, Director of the Brooklyn Botanic Garden, and in the "Nature

Study Review" by Miss Ellen Eddy Shaw of the same institution. The editors have received numerous letters expressing interest and approval in additional to those already quoted.

Centers of distribution for the "Game Laws" reprints have established in North Dakota, Iowa, Ohio, Michigan, Pennsylvania, New Jersey, New York, District of Columbia and Maryland, Massachusetts, Connecticut, and Vermont. Note has already been made of the distribution of a thousand copies by the Brooklyn Botanic Garden, and of a similar distribution to be made by the Washington chapter of the Wild Flower Preservation Society. It is impossible to report in detail further, but it may be noted that over a thousand have been sent out for the Fern Society, probably over fifteen hundred by the time this will have been printed.

Provision has been made for the printing of a hundred extra copies of this number of the JOURNAL for similar distribution. Again the suggestion is made to our members that they put forth their best efforts in aid of wild plant conservation. Make a study of the problem as manifested in your own regions and send in a report. Spread the gospel of protection and practice it when out collecting. Write to your local newspapers and get their interest and support. Support the Fern Society by bringing in new members or by making definite contributions to a fund for this work. The whole problem of wild plant conservation can be simply stated: Have wild plants any rights to existence?—R. C. B.

American Fern Society.

On May 23rd, 1923, there will be a conference in the interests of wild plant preservation held at the New York Botanical Garden under the auspices of the Torrey Botanical Club and the New York Chapter of the Wild

Flower Preservation Society with other organizations. The American Fern Society has been invited to participate as an organization and the attendance of all its members who may be able to be present is requested. There will be morning and afternoon meetings with a picnic lunch at the Lorillard Mansion. Dr. Bartsch of Washington will give one illustrated talk, and the Fern Society will also be represented on the program under the topic "Game Laws for Ferns and Wild Flowers" with R. C. Benedict as speaker.

In this connection readers are requested to send in any information they may have relating to the legal aspects of wild plant protection. Have wild plants any legal rights? Preliminary investigation has established some very interesting points. Please send any information or opinions you may have to R. C. Benedict; also let him know if you plan to attend the meetings.

William Palmer, a member of the Society since 1899, and its president in 1917 and 1918, died in Bellevue Hospital, New York City, April 8, 1921. He was born in London, Aug. 1, 1856. His father, a taxidermist, moved to the United States in 1868 and took a position in the United States National Museum which he held till his death in 1913.

William wished at first to become a physician and tried to get a medical education and earn his own living at the same time. Failing in this, he entered business; but finally yielded reluctantly to his father's insistence that he should follow the paternal profession and joined the staff of the Museum as a taxidermist and modeler in 1874. He married Miss Arminia Knowles in 1883.

Once settled in his line of work, he soon became expert in it. He was particularly noted for his skill in arranging groups of animals; many of those in the new building of Museum are his work. He invented a process for pre-

serving, in approximately their natural state, the plants which are used as backgrounds and accessories in such groups. He was also unusually expert in operating the stereopticon and was much in demand about Washington for this purpose.

He was sent on numerous expeditions for the Museum —to Funk Island in 1887 for remains of the great auk; to Alaska for walrus in 1890; to Cuba in 1900 and 1917; to Newfoundland in 1903; to Mexico, to make a model of a meteorite, in 1904; to Java in 1909; to Florida in 1919. In addition he made many trips to Calvert Cliffs, Md., for fossils: there, in 1917, he was caught in a slide of earth and received injuries from which he probably never wholly recovered. Besides his work for the Museum, he made large personal collections of the birds and plants, especially the ferns, of the vicinity of Washington. These collections he bequeathed to the Museum.

To fern students, Mr. Palmer is probably best known by his article on the ferns of the Dismal Swamp, where he discovered the rare and still somewhat controversial log fern, *Dryopteris Goldiana celsa*, and by his occasional vigorous protests against the naming of minor variants of ferns which he regarded as due to the influence of environment and especially to the disturbance by man, through the cutting off of forests, etc., of the conditions under which the ferns in question grew. It was characteristic of him to seek earnestly for the causes of phenomena he witnessed; and his articles, brief as they are, contain much that is of interest on the relation of plants to their surroundings. Members who were present at the 1916 meeting of the Society at Brooklyn will remember his talk along these lines.

Stewardson Brown, a member of the Society since 1915, died at his home in Germantown, Pa., March 14,

1921. He was born at Germantown, April 29, 1867. His family were lovers of plants; he himself early developed an interest in them. He became a member of the local natural history society while still a pupil in the Germantown Academy and by the time he graduated from that institution in 1885 had pretty well mastered the local flora as it was then understood. He entered the employ of the Lehigh Valley Railroad, but such time as he could spare from business duties was always devoted to botany. He became a volunteer assistant to Thomas Meehan at the Philadelphia Academy of Natural Sciences, and in 1900, abandoning his business career, was appointed curator in charge of the herbarium there. This is a notable collection: to Mr. Brown's conscientious care and arrangement of it botanists owe the preservation and accessibility of a great store of historic material. And those who were at the Society meeting in 1915, or who have had occasion to visit the Academy, will not soon forget his cordial and attractive personality.

Mr. Brown's work was by no means confined to the herbarium. He collected in Florida, the Canadian Rockies, Bermuda, Jamaica, Trinidad, Venezuela, and Porto Rico. He published a "Flora of the Canadian Rockies," and, in collaboration with Dr. Ida A. Keller, a "Handbook of the Flora of Philadelphia and Vicinity." He was editor of "Bartonia," the journal of the Philadelphia Botanical Club, and contributed numerous short notes to it.

Report of the President for 1922.

In reviewing the activities of the Fern Society for the year 1922 the main outstanding feature to be mentioned is the effort, now well under way, to foster the protection of certain native ferns and wild flowers that are seriously in danger of wholesale destruction or extermination.

The matter was first presented to members of the Society by Dr. R. C. Benedict in an article published in the April-June number of the Journal, entitled "Game Laws for Ferns and Wild Flowers," in which the various phases of the subject were considered at some length. In particular, the depletion of the Vermont flora, mainly for the benefit of commercial distributors of living plants, was discussed, with direct reference to the Vermont law (enacted in 1921) designed to protect rare species from being gathered for commercial purposes; this law was reprinted in full. It was suggested as desirable that similar lists of plants needing protection be drawn up for other states, and members of this and other societies were asked to cooperate in contributing observations upon the decrease of species needing protection, in urging the establishment of sanctuaries, and in stimulating public sentiment toward the enactment of restrictive legislation is specially important cases. The article in question aroused wide interest, in response to which the Society contributed funds toward the reprinting and distribution of separates, as explained in the last number of the Journal. These are being widely sent out. The membership of the Society is solidly back of this effort; and, however difficult it may be to gauge the immediate tangible effect of the movement, there can be no doubt of its value as a broad educational measure. Certainly the need of stimulating public appreciation of the danger exists in many quarters. That certain forms of wild life will be wiped out in the neighborhood of large, rapidly growing cities is inevitable; but that this should extend to wild remote regions is unthinkable, if it can be prevented by education in the schools, by the awakening of general public sentiment, by the establishment of natural preserves, and through well considered restrictive legislation. The gain to be derived from legislation lies more in its advertising value

than in mere prohibition and penalty features. Above all it is incumbent upon those advocating plant conservation to escape the rôle of faddists, and to urge only the protection that is truly essential. Otherwise the movement is, at the outset, foredoomed to failure. Our watch-word should be "education and sane publicity."

As bearing upon a new line of activity advocated a year ago attention should be called also to Dr. Benedict's article, "Ferns as House Plants," which appeared in the third number of the Journal for 1922. There has been a phenomenal increase in the commercial growing and wide sale of in-door fern in recent years, and this article gives precisely the information needed for the proper selection and care of the more important, commonly cultivated kinds. These are mainly exotic, and their number will certainly increase steadily in the face of demand for additional species. Brief queries or notes on success or failure in growing ferns as house plants would be welcome additions to the pages of the Journal. The dearth of short articles referred to last year still exists, and it ought to be remedied. The failure of members to take full advantage of the opportunity to exchange notes and specimens through the medium of the Journal is difficult to understand; also, it is not helpful to the officers and editors, who desire most of all that our publication may be of special usefulness to the large number of amateur students chiefly comprising our membership, now, as last year, at about three hundred.

The special committee on membership appointed two years ago is striving to add new members, and in this desires your assistance. A number of the circulars of March 20, 1921, setting forth briefly the history and aims of the Society and the advantages of membership, are still on hand and will be forwarded if requested. To this committee, the Editors, and the Curator of the

Herbarium, we are all under great obligation for their painstaking efforts on behalf of the Society during the past year. We are particularly indebted also to Professor Winslow, not only for mailing current issues of the Journal but for storing back numbers and successfully soliciting the sale of sets. Storage and mailing are a burden which he has borne patiently for many years and of which he should be relieved in some way during the coming year.

Owing to ill health, Mr. Burnham, Secretary for the past four years, has found it necessary to retire from active participation in the affairs of the Society at the close of this year. To him are extended the sincere thanks of the members for his faithful and efficient services.

Respectfully submitted,

WILLIAM R. MAXON,

President.

Report of the Secretary for 1922.

Several of the members attended the third exhibition of native ferns and flowering plants made by the Massachusetts Horticultural Society at Horticultural Hall, in Boston, May 3–13. There was also a meeting of the American Fern Society at Cambridge, Mass., in connection with the meetings of the American Association for the Advancement of Science, December 29, 1922.

During the year, word has been received of the death of four members:—Henry C. Bigelow, T. Lynton Briggs, Mrs. Nellie F. Flynn and William Palmer. Fifteen members have been added to the Society and the membership (Dec. 31, 1922) stands at 303, a gain of two over last year.

After serving for four years, the present Secretary refused renomination. He wishes the new Secretary and

the officers of the Society the continued support of its members: and that the membership of the Society may be substantially increased.

S. H. BURNHAM,
Secretary.

Report of the Editors for 1922.

The JOURNAL was favored this year with a budget appropriation of $45 in addition to the regular expense of publication. The editors have greatly enjoyed the ability to run occasional extra pages and extra illustrations which this appropriation has given them. With its aid and that of a much appreciated gift from Mr. C. C. Deam, and with the cooperation of the Brooklyn Botanic Garden in connection with the article on ferns as house plants, eight full-page plates have appeared and a total of 139 pages has been published. This happy state can hardly be expected to continue next year, however, since the printers have found it necessary to raise their price by just about the amount of the extra appropriation.

"It has pleased me a great deal," writes one member, "to read the articles in the last issue of the AMERICAN FERN JOURNAL along lines that have always interested me, and I am sending a photograph of a freak *Polystichum acrostichoides* which I have been growing for eight years." It pleases the editors immensely to get letters like this, not merely because they like the approval of the constituency they serve—strong as is that element—but because such letters furnish the best, almost the only, means by which they can judge whether the JOURNAL as made up really meets the desires of the members of the Fern Society.

Of course, it is obvious (and old) that the JOURNAL will consist only of what is received. The editors can

influence the contents only as they contribute directly. The past year has seen rather frequent contributions of this sort, but they have displaced nothing else. If it had not been for them, the JOURNAL would have been late through lack of copy, as well as through printing delays. Indeed, even as it was, part of the lateness of the different numbers has been chargeable to scarcity of material to put into them. We are happy to find, however, that with the issue of no. 4, we are nearly back on schedule time.

In what line of fern study are you particularly interested? Like Dr. Logue, whose letter is referred to above, in variations from the typical? In ferns as plants for the wild garden or for the house? In hiking, mountain climbing, or boating, with ferns as the particular hobby in outdoor life? In conserving the present wild life, ferns and other things? In making an herbarium collection of as wide a variety as forms as possible? In ferns as botanical material of exceptional interest?

Probably most of us combine several or all of the above items of interest. We are sure that every member has ideas on ferns which would be of interest to others. Please sit down the next time something interesting occurs to you and send it in, either as a formal article or as a letter from which points may be extracted. Illustrations we are glad to receive. We cannot use all we should like to use, owing to limited funds, so are particularly glad when, with the photograph or drawing, is contributed also the cost of reproduction.

A good many members have helped us in these ways: we tender them our heartiest thanks. We wish that many more may do so in future.

R. C. BENEDICT,
E. J. WINSLOW,
C. A. WEATHERBY,
Editors.

Report of the Judge of Elections.

As Judge of Elections of the American Fern Society, I make the following report of the Election of Officers held in November, 1922. The total number of ballots cast was 97. Of these 8 were unmarked. The vote as shown by the remainder was as follows:

For President	For Vice-President
Wm. R. Maxon.....89	Miss M. A. Marshall.....89
Washington, D. C.	Still River, Mass.
For Secretary	**For Treasurer**
Rev. Chas. S. Lewis.....88	J. G. Underwood.....88
Trenton, N. J.	Hartland, Vt.

I therefore declare the above-named persons elected.

Respectfully submitted,

JAMES C. NELSON,
Judge of Elections.

As usual in recent years, the Treasurer's report has been delayed by the lateness of the JOURNAL. No report had been received from the Curator at the time of going to press.

New members:—

Hazen, Edwin Humphrey, 373 Crown St., New Haven, Conn.
Jardine, Miss Margaret I., Cushman Road, Hartsdale, N. Y.
Parker, Mrs. Anna C., 51 Western Ave., Cliftondale, Mass.
Somerville, Mrs. J. H., Superior, Wis.

Change of address:—

Topping, D. Leroy, P. O. Box 2356, Honolulu, T. H.

On December 29th, in spite of the very discouraging weather, about thirty members and friends of the Fern Society gathered in the building of Massachusetts Institute of Technology on the wind-swept shore of the Charles River. There was an interesting exhibit of

drawings, photographs and mounted ferns, and occasional calls by old friends who dropped in from some of the various departments of the A.A.A.S. in session in other parts of the building, all of which added interest to the social hour in the early part of the day.

At the formal program in the afternoon Vice President Marshall wielded the gavel. E. H. Clarkson gave an interesting talk upon variations in the Christmas Fern, illustrated with drawings and specimens. Dr. Tilton spoke briefly of his new fern book just received from the binders, and gave some reminiscences of Davenport and other New England fern students. Miss Marshall exhibited specimens of a proliferous Ebony Spleenwort and described the collecting of it and its development during several years in the basement of a school building. Mr. Palmer spoke of the ferns of Missouri, and told the story of the finding of *Isoetes Butleri*. Mr. Weatherby exposed some of the mysteries of fern nomenclature with special reference to the work of Diels in "Die Natürlichen Pflanzenfamilien" of Engler and Prantl. Mr. Rugg exhibited and spoke of *Adiantum pedatum* var. *aleuticum*, recently collected in northern Vermont. Mr. Underwood invited the Society to hold their next meeting with the Vermont Botanical and Bird Clubs in Middlbury, Vt., next summer.

The interest of the occasion was enhanced by the presence of a good number of botanists from outside the state. These included Mr. Palmer from Missouri, now temporarily located at the Arnold Arboretum in Boston, Treasurer Underwood, Mr. Rugg and Mr. and Mrs. Carpenter from Vt., Dr. Grout from New York City, and Miss Lorenz, Miss Upham and Mr. Weatherby from Conn.

We are indebted to the generosity of Dr. Edgar T. Wherry for the illustration which accompanies his note on wall-ferns at Wilmington.

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Vol. 13 April-June, 1923 No. 2

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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The American Fern Society

Council for 1922

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MISS M. A. MARSHALL, Still River, Mass. - *Vice-president*
S. H. BURNHAM, Ithaca, N. Y. - - - - *Secretary*
J. G. UNDERWOOD, Hartland, Vt. - - - *Treasurer*

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American Fern Journal

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A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.

American Fern Journal

Vol. 13 APRIL–JUNE, 1923 No. 2

How to Distinguish the North American Species of Equisetum[1]

John H. Schaffner

In a previous paper on Equisetum,[2] the writer discussed the status of the North American species north of Mexico and gave a synopsis to indicate the evolutionary sequence and phyletic relationships. Such a synopsis is, however, not always convenient to use for identification of casual specimens collected in the field, and since there seems to be much confusion and uncertainty in regard to certain species at present, the following treatment has been prepared especially for the use of amateurs who must depend on a key for the recognition of the species.

Because of the decided simplicity and sameness of structure exhibited by most species of Equisetum and because of the great fluctuations often shown by a single species, it is important that one should learn to recognize them by such hereditary characters as appear to be least influenced by external conditions. An attempt has been made to discover such characters so far as possible for the key. In a few cases the writer is still not able to segregate definitely on vegetative characters alone although this is clearly the goal which should be set for every field manual. Although several species are fairly well characterized by anatomical characters of the stem,

[1] Papers from the Department of Botany, The Ohio State University. No. 137.

[2] Schaffner, John H. North American Species of Equisetum North of Mexico. Am. Fern Jour. **11**: 65–75. 1921.

[Vol. 13, no. 1 of the Journal, pages 1-32, plate 1, was issued March 13, 1923.]

in the main such characters are no more serviceable than the external characters, since they are subject in the same degree to the influence of environment. This notion of the greater stability of internal structures seems to have been handed down from the time when a belief in the inheritance of acquired characters was quite common. Any one familiar with cytology and histology cannot entertain such a notion. Temperature, light, moisture, etc., affect internal cells as well as those exposed on the surface.

The present paper does not consider the ecological and minute hereditary forms but aims to include all of our species, well-marked varieties, and hybrids. Large numbers of varieties and forms have been named and described but it is a well-known fact that most of them are of no value whatever. Immature individuals and extreme fluctuations should be avoided by the beginner as they may even confuse the would-be expert. Although there are probably a considerable number of true varieties with definite, minute hereditary characters, these have never been studied in such a way as to segregate them from mere fluctuations and until this is done it seems best to include them all under "forms," which represent merely the characteristics the specific hereditary factors express or assume under the given environment. The true nature of the puzzling forms which appear to be hybrids can only be determined by actual breeding experiments. Morphological and distributional studies may give a strong presumption in favor of a supposed hybrid nature but they can never determine the matter. Genetics must give the solution. However, if a form is constantly developed with imperfect spores, the presumption in favor of its hybrid nature is very strong. Fluctuations or ecological "forms" may be determined by field studies and by transplantings to different habitats. Frequently one can find quite diverse

forms from the same rhizome, especially when it extends through two or more well-marked zones of environment.

Characters Peculiar to the Species

Equisetum scirpoides can be readily identified by its solid stems and by having twice as many ridges as persistent sheath teeth. The teeth are three in number and are bicarinate or somewhat quadricarinate. Some forms of *E. variegatum* may have solid stems but these are distinguished by their 5–10 quadricarinate teeth. *E. telmateia* also has twice the number of ridges on the green branches as persistent sheath teeth, but cannot be confused with *E. scirpoides* because of its prominent hollow main stem and regular whorls of branches.

E. kansanum and *E. funstoni* are apparently closely related. Eaton, however, thought them distinct, since he was well acquainted with *E. kansanum* which he called *E. laevigatum*. Until Eaton described *E. funstoni* as a new species it was usually cataloged under the name of *E. mexicanum*. To the writer, who described *E. kansanum*, the two forms seem distinct enough to merit specific rank. *E. funstoni* has a peculiar cluster or rosette of more or less spreading or horizontal branches coming from around the base of the main fertile or sterile stalks, and these branches often branch again above ground. The teeth of the sheath are long persistent, the ridges are usually exceedingly rough with projecting cross bands of silex and the sheaths have a strong tendency to be incurved at the top. *E. kansanum* is destitute of a basal rosette although sometimes the stems are more or less clustered, several cone-bearing shoots of various sizes coming from one erect underground branch of the rhizome. The ridges are usually very smooth because of the slight development of the cross bands of silex. In the southwest and Pacific coast, especially California, the plant may be practically as

rough as *E. funstoni*. The Californian form of *E. kansanum* has, recently, usually gone under the name of *E. funstoni nudum*. But it is quite similar to the eastern plant in appearance except for its rougher nature. The sheaths of *E. kansanum* usually do not curve in at the top and the teeth are commonly early deciduous except those of the calyx-like sheath at the base of the cone. *E. kansanum* is strictly annual in its aerial parts. In both species the cone is without a point and the sheaths are green and funnel-shaped. The main stems of both species may have sporadic branching.

Large specimens of *E. kansanum* often look much like *E. laevigatum* and this probably accounts for the fact that the two were confused for such a long time. *E. laevigatum* is much more robust and usually rougher. The fundamental characters which separate it from *E. kansanum* and *E. funstoni* are the apiculate cone and the evergreen habit of its aerial stems. *E. laevigatum* may also be confused with *E. praealtum* when the latter is immature. Normal mature individuals, however, can be distinguished at a glance. *E. laevigatum* has long ampliated green sheaths with a narrow black limb. The upper sheaths are rarely if ever discolored, although those near the ground may approach the ashy-colored appearance of *E. praealtum*. *E. praealtum* has close short cylindrical sheaths, usually split in age and soon drying off into an ashy gray color, commonly with a band of black above and below.

E. praealtum and *E. hiemale*, including both European and American forms of the latter, are readily distinguished from each other by their sheaths and ridges. The sheath segments of *E. praealtum* are tricarinate, without a central grove, except rarely a very slight one, and the ridges of the internodes have a single row of tubercles, while *E. hiemale* has quadricarinate sheath segments with a distinct groove between the two central keels and the

ridges of its internodes have two rows of tubercles, appearing biangulate. Although perennial, *E. praealtum* usually bears cones on shoots of the season. Shoots sterile the first year may bear cones the second, both terminal and on lateral branches. Branching is rare the first season unless the shoot is injured but the second year branching is common even on uninjured shoots. *E. praealtum* is an exceedingly variable species, some forms recognized probably being genetic and some ecological, but none of these forms passes outside of the specific limits as usually drawn. Some are short and robust; some tall and massive; some very slender. One variety, *E. ferrissi* Clute, has exceedingly long internodes but this character seems to intergrade with the usual type, at least in some localities.

E. variegatum is sometimes confused with *E. praealtum*, *E. hiemale*, *E. laevigatum*, and even *E. kansanum*. Since the ridges of the internodes are biangulate except in the variety, *E. variegatum nelsoni*, this character alone should separate it readily from all of them except *E. hiemale*. The character of the persistent teeth is distinctive, all the species named above have early deciduous teeth except sometimes *E. kansanum* with which *E. variegatum nelsoni* might be confused if the latter is really annual as supposed. Since *E. variegatum* in all of its varieties has persistent teeth (never more than the bristle tip being deciduous) the tooth character with the small number of ridges (5–10) should be sufficient for identification. The cones of *E. variegatum* are apiculate and this character will readily separate it from *E. kansanum*. *E. variegatum nelsoni* when fully studied may be found distinct enough for specific rank which has already been accorded to it by Farwell. The question naturally arises whether it is an extreme annual-stemmed mutation from the *E. variegatum* line or whether it may not have its natural affinities with *E. laevigatum*, *E.*

kansanum, and *E. funstoni*. The writer is not well enough acquainted with the plant to express an opinion since he has never studied it in the living condition in its natural habitat. *E. variegatum jesupi* is readily associated with *E. variegatum* by its external characters. It appears to be a hybrid as shown by Miss Holden. It should always be distinguishable by its persistent bristle tips and the absence of spiral thickenings in the wall cells of the sporangium as well as by the abundance of abortive spores.

The smaller sterile shoots of *E. telmateia* are often confused with *E. arvense*. But the two are very distinct. *E. telmateia* is distinguished from all others of our branched species by the prominent bicarinate sheath segments of the branches, and the fact that the ridges of the internodes of the branches are deeply grooved thus making twice as many ridges as the teeth of the accompanying sheath. All the other related species, as intimated above, have unicarinate sheath teeth on the branches, and the ridges of the internodes are equal to the teeth. The fertile shoots of *E. telmateia* are usually distinguished by the size of the cone and the leaf sheaths and by the lack of stomata on the internodes.

E. silvaticum can be recognized by the peculiar union or coherence of the sheath teeth of the main stems into three or four broad lobes and by its compound branches. *E. arvense* often has compound branches but the teeth, although they may cohere to some extent, do not form peculiar broad lobes. The branches of *E. arvense* have a tendency to be erect, while those of *E. silvaticum* have a strong tendency to be spreading and recurved. Sometimes the branches of *E. silvaticum* are also nearly simple so the sheaths of the main stems, both sterile and fertile, are the best distinguishing character.

E. fluviatile can be identified by its very large central cavity and hollow terete branches. The unbranched

forms are readily identified by the persistent teeth of the close green sheaths, together with the annual character of the aerial shoots and the scattered stomata.

E. pratense is distinguished definitely from its near relative, *E. arvense*, as well as others, by the shape of the sheath teeth on the branches. They are deltoid, obtuse or merely acute and usually green with broad white margins.

E. arvense is to be recognized by its awl-shaped or acuminate unicarinate sheath teeth of the branches. The teeth are frequently four or more but sometimes three, while *E. pratense* seems to have three teeth on the sheath quite regularly. The compoundly branched sterile shoots must be distinguished from *E. silvaticum* by the sheath character of the main stems; as stated above, the teeth of *E. arvense* do not cohere into three or four continuous lobes but the coherence is slight and indefinite.

E. palustre is characterized by its loose sheath, usually with less than ten teeth, and its internodes with six to ten ridges and small central cavity. The branches of the whorls are commonly long giving the shoot a bushy appearance. They are terete and hollow as in *E. fluviatile*. It is mainly confused with peculiar forms going under the name *E. litorale* Kuehl. But *E. litorale* has short cones with no spiral thickenings developed in the wall cells of the sporangium and the spores are abortive and commonly without elaters. *E. litorale* apparently represents semi-sterile shoots of *E. palustre* and also hybrids between *E. palustre* and *E. arvense* and perhaps also between *E. fluviatile* and *E. arvense*. Specimens without cones of *E. litorale* are usually not definitely distinguishable from *E. palustre*.

Based on the characters discussed above, the following key has been prepared to facilitate identification of both sterile and cone-bearing shoots of our North Ameri-

can species, important varieties, and hybrids. Although some overlapping may be found in the branching character, this is usually so definite that most specimens should be readily identified excepting the very young and the badly weathered individuals.

COLUMBUS, OHIO

(To be continued)

Observations on the Climbing Fern in Pennsylvania

ROBERT J. SIM

Porter's old record of *Lygodium* for Luzerne County aroused my curiosity as to the present status of this plant there. So, upon meeting Mr. Philip Brierley, a botanist of the Federal Horticultural Board, at Freeland, I at once mentioned the possibility of finding the Climbing Fern in that region. The next day, Sept. 19, 1922, Mr. Brierley guided me to the place where he had already located it.

This station is in the bottom of a deep and wide wooded valley between two mountain ridges. The limits of the colony were not reached. For all I know there may be, up and down the valley, miles of territory included. At any rate, during my two visits (the second on Oct. 1st) the fern was seen to form the dominant green of the undergrowth on many acres of ground. So far as noticed, only the bottom of the valley is occupied—the sloping banks and flat terraces within fifty feet of the creek-level. No deep and permanently shady forest of large trees is there, but the presence everywhere of second-growth or thicket makes a changing mosaic of sun-light and shadow which seems to fill the requirements of *Lygodium*. The soil may be described as a sandy loam—the combination of accumulated humus and material from the weathering cliffs of the flanking

mountain ridges. Under the most luxuriant tangles of the fern the ground is rather well drained and has only a medium or slight degree of moisture.

In some places, many rods in extent, almost every upright herb or shrub stem is entwined by one or more fronds of *Lygodium*, and the ground for a slight depth is filled with a network of the slender horizontal root-stocks. The graceful ascending fronds reach upward from three to five feet, but some specimens when unwound from their supports are five and a half feet in length. The lower half has the larger hand-like, foliaceous pinnae, while the thread-like upper half bears the exquisite lacy fruiting branches. One of the most striking features is the pale pinkish-yellow color of the rachis, an appearance quite suggestive of some species of Dodder. In little open spaces where no supports are available, the Climbing Fern sprawls over the ground, but here few of the fronds are fertile.

With the assistance of Mr. Brierly I made the following list of associated plants:—

ON HIGHER GROUND AND SLOPING BANKS.

Acer rubrum L.
Quercus alba L.
" *rubra* L.
" *prinus* L.
Castanea dentata Borkh.
Pinus rigida Mill.
" *strobus* L.
Populus grandidentata Michx.
Fagus grandifolia Ehrh.
Betula populifolia Marsh.
Crataegus sp.
Hamamelis virginiana L.
Rhododendron maximum L.
Kalmia latifolia L.
Rhus copallina L.
Cornus alternifolia L.
Myrica asplenifolia Ehrh.
Quercus ilicifolia Wang.
Pteris aquilina L.
Dicksonia punctilobula Gray.
Polystichum acrostichoides Schott.
Dryopteris noveboracensis Sw.
Fragaria sp.
Rubus hispidus L.
Potentilla canadensis L.
Gaultheria procumbens L.
Epigaea repens L.
Mitchella repens L.
Lycopodium clavatum L.
" *obscurum* L.
Polytrichum sp.

UNDER TSUGA—ACER—QUERCUS SECOND-GROWTH ON LOWER GROUND.

Rhododendron maximum L. *Osmunda regalis* L.
Salix sp. " *cinnamomea* L.
Sphagnum sp.

It appears likely that this hardy and quaintly decorative plant may prove to be more common than has been supposed, among the mountains of Pennsylvania. Moreover it seems odd that it has not become a general favorite in ferneries, conservatories and "wild" gardens. For what could be more picturesque than the pattern of soft green palmate leaves and the delicate tracery of tendril-like fruiting sprays twining above?[1]

PENNSYLVANIA BUREAU OF PLANT INDUSTRY.

Botrychium dissectum

O. A. FARWELL

In the Botanical Gazette for Nov. 1920, Vol. 70, pp. 387–398, Dr. C. J. Chamberlain presents data tending to show that *Botrychium dissectum* is a sterile mutant of *B. obliquum*, using the latter name in a broad sense to include all its variations. Insofar as his experience of five years goes, *B. dissectum* occurs only in association with *B. obliquum*.

Botanists of a century or so ago considered the two forms to be distinct species; as, Willdenow, Sp. Pl., V, 63, 64, (1810); Pursh, Fl. Am. Sept. II, 655, 656 (1814); Nuttall, Genera, II, 248 (1818); Barton, Comp. Fl. Phil., II, 205 (1818); Beck, Bot. N. & Md. States, 459 (1833). They are united by Torrey in the Fl. of the St. of N. Y., II, 506 (1843) as *B. lunarioides* Swartz, and var. *dissectum*. In the various editions of Gray's

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[1] The reason probably is, that the climbing fern is difficult of cultivation, requiring rather special conditions and, in particular, soil of so high an acidity that most garden plants would not grow with it.—C. A. W.

Manual, under whatever specific name used, the two forms have been considered as variations of the same species with the form having the dissected margin as the variant. However, from a taxonomic point of view, *B. dissectum* Spreng., Anleit., III, 172 (1804), being the first published, is the type. *B. obliquum* Muhl. in *Willd.*, l. c., 63, becomes *B. dissectum* var. *obliquum* (Muhl.) Clute, Fern Bulletin, X, 76 (1902). *B. dissectum* probably has had no other name; but *B. obliquum* has passed under several, such as *fumarioides, lunarioides, ternatum*, etc.

In so far as my slight field experience and acquaintance with this species goes, it shows no intermediate forms between it and its variety *obliquum*. The general outline and size of fronds are the same, the size of the fruiting panicles of each is the same; but the sporangia are slightly smaller than those of the variety with a few that are smaller because undeveloped; but the same condition occurs in var. *obliquum* in which the terminal sporangia are rarely as large as the lower ones. The spores are plentiful and mostly full and plump but some are smaller and angular. In the variety *obliquum* the ultimate divisions are ovate or oblong and the margin finely crenate-serrulate; in the type the corresponding divisions are laciniately pinnatifid and incised or crenately serrate. In separating variety *obliquum* from the specific type, all individuals whose ultimate divisions have a margin that is essentially evenly crenate-serrulate, that is, where most of the serratures are of about the same size and not over one mm. in length, are placed in variety *obliquum;* those plants where the indentations of the margin, in part or all, extend one-third the distance to the midvein or more, are placed in *B. dissectum*. In the latter case, every third or fourth indentation is two to four times as deep as the others, forming a tooth that is itself incised or serrate, whence the name *dissectum*.

In southeastern Michigan, both forms are infrequent but the variety is the commoner of the two.

My first collection of *B. dissectum* was in a small copse within the city limits of Detroit in 1906; this station has since been destroyed through the clearing of the land for building purposes. There was no other form of the species there, variety *obliquum* being conspicuous by its absence.

September 28, 1922, while botanizing in St. Clair County with Mr. Gladewitz, of Detroit, Michigan, we found two distinct colonies of this species. We had traversed the perfectly flat top of a ridge or hill about one-eighth of a mile long, ten to twenty feet high and from ten to twenty yards wide, perfectly innocent of any growth of shrubs or trees. There was a slight fringe of trees on the west between the hill and a cornfield; on the east was an extensive lowland flat well covered with Oaks, Beech, Yellow Birch, Balsam Poplar, Sour Gum and other species of trees. At the southern end of the ridge on the east side in a small cleared spot in front of the woods we found the first colony of *Botrychium*. At that season of the year the only associate vegetation noticeable consisted of leaves of grasses and one sedge; the only grass determinable was *Muhlenbergia Schreberi* and the sedge was *Carex Swanii*. While we did not stake out and tabulate the number of individual plants, there were probably in the vicinity of forty, all told, in a radius of eight feet from the first plant seen, which was the variety *obliquum*. *B. dissectum* made up fully one-third of the colony. As we traveled back through the woods we did not detect any other colonies as the grasses, sedges, etc., were too rank to permit of their growth there. In a small cleared spot at the north end of the hill, we found another colony consisting of three fronds only of *B. dissectum;* in a radius of eight feet from these three fronds no other

Botrychium frond was discovered. Most of the *B. dissectum* fronds were deeply divided and open, as illustrated in Britton & Brown, 2nd Ed.; the remainder were less divided with closer segments as illustrated in Gray's Manual. It seems probable that the variety *obliquum* may be the genetic type of the species while *B. dissectum* may be a form with jagged or incised margins, a condition that is frequent in many and various species of ferns; but since, as stated above, the dissected form was the first described and named it becomes the taxonomic type of the species. Of the three colonies which I have seen, two were of *B. dissectum* alone, the first containing around a score of plants, and the plants in both colonies bore the deeply divided open fronds of the type. Mr. Gladewitz informs me that heretofore he has observed *B. dissectum* about 10 times and in every instance associated with its var. *obliquum* about in the proportion of 2 of the latter to one of the former. Some might propound the suggestion that there are two species *B. dissectum* and *B. obliquum* representing extremes of marginal serration while the intermediates mentioned by Mr. Hopkins of Kent, Ohio, found where both grow together are the result of cross fertilization.

PARKE, DAVIS & CO., DEPARTMENT OF BOTANY,
DETROIT, MICHIGAN.

Autumn Frosts and the Ferns

EDWARD H. CLARKSON

Up to October 17th, 1922, there had been several light frosts in the vicinity of Newburyport, Massachusetts, with minimum temperatures of 32° F.

In the fern garden, the big Osmundas, the ostrich ferns, the marsh, New York and Massachusetts ferns, the bracken, both of the chain ferns, the little long beech and oak ferns, the sensitive ferns, and the silvery spleen-

wort were nearly all browned and shrivelled. Most of the fronds of the maidenhair, lady ferns and hay-scented ferns were curled and dead. Yet in places where they were somewhat protected by surrounding foliage, a few of the last named were still green and fresh. Many of the tall fertile fronds of the big Clinton's fern, the crested fern, and the handsome hybrid, *Dryopteris Boottii*, more or less browned or discolored, had fallen over. Even the big Braun's holly ferns were all flat on the ground. It seems strange that this vigorous semi-evergreen species should be so sensitive to light frost or to cold rain and wind, yet it is apt to fall rather early.

During the nights of October 17, 18 and 19, there was a sharp drop in temperature, the mercury falling to 24° F. Water in shallow receptacles on the lawn froze solid and the surface of the ground was slightly frozen in a few spots. As a result of this cold weather, the big, handsome Goldie's ferns, that three days before were as erect and vigorous-looking as in midsummer, were lying flat on the earth. This fern, like the male fern, seems to be intermediate between the evergreen ferns and the more tender sorts and its fronds, although flat on the soil, keep fresh and beautiful for some time after the cold, freezing weather arrives.

The Clinton's ferns, many of which were still erect and vigorous-looking on October 17th, had also fallen. The broad beech ferns, that were fine and green then, were all frozen and shrivelled, and the last of the lady ferns had succumbed. Even the hardy evergreen species, the polypody, Christmas fern, marginal fern, and the two spinulose ferns, *Dryopteris spinulosa* and *D. intermedia*, were all awry and out of shape. It was very interesting to notice how curled and faded at that time were the broad-leaved spinulose ferns, *Dryopteris dilatata*. Although their home, here in New England, is in the cold mountainous regions, they, curiously

enough, unlike the other two spinulose ferns, are not evergreen.

It would seem that the stems of many of the first-growth fronds of our native ferns are in a weakened condition in autumn, so that a number of species are ready to fall. Sometimes the immediate cause of their falling is a frost. Sometimes a cold rain-storm or even a strong wind will bowl them over. Mature fronds will occasionally drop down just from their own weight, because weakened at the base of the stems.

After the hard frost recorded above, I found a few fronds of the more tender sorts still alive and as beautiful as ever. These included the New York, hay-scented, maidenhair, and Goldie's ferns. But in every case these surviving fronds were those that had come up late in summer. The early-growth, mature fronds do not have the vitality to resist extreme cold. In my fern garden is a fine clump of the Dodge hybrid, *Dryopteris cristata* × *marginalis*. In September, 1922, it sent up a dozen delightfully irregular fronds, most of which were fertile. After these had fully expanded, all the first-growth fronds of the group fell over on the ground. As late as November 16th, these twelve September-growth fronds were as erect, green, and fresh as if it had been June instead of nearly Thanksgiving.

I particularly prize this special cluster of ferns because I dug it on the last trip that I took with Raynal Dodge. It was not many weeks before he died that he told me he would like to visit a colony of this hybrid in Byfield where for many years he had gathered fronds for his herbarium. We found them just right for collecting and Mr. Dodge gathered a goodly number. At his suggestion I dug a clump for my fern garden. He said that this was one of the first places where he had found the hybrid and I think that he sent living plants from this particular group to George E. Davenport in 1891 or 1892. Therefore the cluster is at least thirty years old.

NEWBURYPORT, MASS.

The Mosquito Fern

R. C. BENEDICT

It has long been a belief of mine that a whole course in botany including genetics, morphology, physiology, palaeontology, etc., could be built around a selection of ferns as illustrative material. To be sure, there would be some deficiencies when it came to illustrating adaptations for cross fertilization through special types of floral leaves and attraction of insects by colors, odors, and nectar. Such lacunae could well be filled in, however, by drawing the necessary material from the flowering plant offshoot of the fern family as needed, returning to the parental line of the whole vascular plant group when the side excursion was over.

Without going further into a general discussion of the manifold variation of the ten thousand different kinds of true ferns (Filicineae) I would like to offer some facts and observations regarding the versatility, botanically and biologically speaking, of the mosquito fern, scientifically called Azolla. Let me offer them topically.

WHY MOSQUITO FERN? Some twelve to fourteen years ago, Dr. Marshall A. Howe of the New York Botanical Garden, while collecting algae in Central America, was asked by a German scientist for a possible place abroad where Azolla might be procured. They wanted it to introduce into standing water to cover the surface so that mosquito larvae might be unable to rise for oxygen. Dr. Howe was able to refer them to a nearby locality where he had recently seen Azolla growing. Textbooks in biology always cite as preventives for mosquito larvae, drainage, screening, and covering with oil, and the introduction of small fish. I hope they will now add Azolla as a competitor of the Standard Oil Co.

COMMENCALISM, SYMBIOSIS, PARASITISM. These three formidable words represent possible gradations in the

relations of two distinct species of living things which have the habit of always occurring together. The best illustration of commencalism I know of is that of the Javan fern-ant combination, in which the fern rhizome is regularly enlarged and hollow, furnishing a living place for a family of ants whose formic acid secretions, as well as their biting ability, serve to protect the fern from herbivorous animals. Azolla is another good case, although its exact status is as yet undecided. Each of the leaves visible in the illustration has a considerable hollow which develops as early as the second embryo leaf, and which serves only, so far as known, for an abiding place for a low form of alga, *Anabaena Azollae*, whose cells grow in close association with those of the Azolla. When Azolla reproduces, the Anabaena works its way into the spores. There is probably mutual benefit in the association.

REPRODUCTION AND DISTRIBUTION. Students of biology are familiar with the commonly cited examples of these terms. The cocoanut is a fruit adapted for water distribution. The devil's horn has a fruit adapted for the bur method of dispersal. The potato is a case of vegetative or asexual reproduction. During the summer of 1922 a few plants of *Azolla caroliniana* appeared in the lower reaches of the brook ot the Botanic Garden in Brooklyn. By the end of September the plant could have been measured by the peck, if not by the bushel. The branching, breaking apart and continued growth of colonies of the type illustrated resulted in a multiplication of "extraordinary rapidity," as Prof. Campbell writes (Mosses and Ferns, page 396). Wind and water currents served to distribute the plants along about five hundred feet of open sunny brook. The margins of this were completely lined with mosquito fern, and the terminal pool, into which the brook plunged, contained masses which could be scooped out in double handfuls.

The bur method applied to reproduction is illustrated in Azolla in the fact that its "pollen" spore masses are provided with projecting hooks which serve to hold the two types of prothallia together for sexual reproduction.

FALL COLORATION. No textbook in botany is complete without its reference to the changes in pigmentation of the leaves associated with autumn. Beginning in September with cooler weather, the margin of Azolla along the brook mentioned above began to take on a magenta tone. Through October and November the color became more pronounced. Examined closely, each plant showed a central shade of olive with the margins of all the leaves bright crimson. In the greenhouse grown material of the illustration, it will be noted that the margins appear paler than the center. If red-margined they would have photographed darker. The fall coloration for tree leaves is sometimes ascribed more to drying than to cold, an explanation not applicable to Azolla. In the case of plants which were considerably shaded, the red color did not develop to the same extent. In reddened plants brought into the greenhouse for observation, the old leaves remained of darker shade but the new growth was paler.

HARDINESS. As the weather became colder through the fall, the amount of Azolla grew less. It happened that the fall of 1922 was mild. The first frost was late in October and not very severe. The Azolla continued alive through November, suffering temperatures of not much lower than 29 degrees Fahrenheit. By the first of December the artificial supply of water was shut off, and the Azolla could be seen only as a reddish margin along the muddy banks of the empty brook bed.

Has anyone any accurate information as to the repeated occurrence of *Azolla caroliniana* in the eastern states? A few years ago I saw masses of it filling one of

Mosquito Fern under Greenhouse Culture

(Enlarged 2–3 times)

the locks of the Delaware and Essex Canal near Glen Ridge, New Jersey. It was September and I remember a reddish coloration like that noted above. Does it occur there year after year?

BROOKLYN BOTANIC GARDEN.

How to Save the Wild Flowers

THE TRANSPLANTING OF WILD PLANTS IN GENERAL AND THE MOUNTAIN LAUREL AND RHODODENDRON IN PARTICULAR.

MABEL OSGOOD WRIGHT.

We have heard and read so many sermons built about the text "Touch not—take not," where the wild flowers are concerned, that it is a very pleasant change to be moved by practical experience, coupled with the necessary spirit of the age—*compromise*—to substitute "please do" for the everlasting "you must not."

Conceding, as a matter of course, that trees, flowers and ferns are best seen in their native haunts and that *any* handling *whatever* must dispel some of the elusive wildness of their charm, conditions of material progress are making it very difficult, if not well nigh impossible, to keep many of these haunts intact without exerting that frantic and unreasoning fanaticism that finally, but surely, defeats its own ends.

The various societies for the preservation of the wild, aided by both Federal and local cooperation, *may* be able to preserve certain great stretches of forest lands and by educational propaganda, to curb the indiscriminate gathering of attractive, but very perishable, wild flowers—especially certain biennial species like the Blue Fringed Gentian that depends wholly upon seeds for its perpetuation. Yet all this avails nothing when

the haunts themselves *must* be destroyed for either cultural or sanitary necessity, such as the using land for the building of great resevoirs like those of the Croton watershed, and our own wonderful Hemlock Woods reservoir, that is soon to extend through Easton quite up to the Den District into The Valley Forge, not so long ago the very heart of our wild flower excursions, where we flower lovers, came, saw, analyzed the new and gathered a mere handful to take home, carefully bound about with wet moss.

If we would preserve the wild things in their haunts. let us re-create these haunts upon soil that is still under private control and intelligently remove the vanishing wild species to it. Not casually or carelessly, but after due study and supplying of proper soil conditions, acid or alkalin, dry, moist or really boggy, according to the several needs of our guests. The *sentiment* concerning the protection of wild things and the *law* are at variance in respect to inanimate objects. We read, "*The wild bird is the property of the State,*" wherever it may lodge, and since the passage of the Federal Migratory-Bird Law, the property of the Nation; but tree, shrub, herb, and fern belong absolutely to the owner of the soil upon which they grew, to be gathered and sold at will. The only possible legal curb might be the prohibition of selling outside of State limits, and this step might be proved unconstitutional.

Our legal efforts to protect Connecticut's State flower, the Laurel, could only go as far as forcing the users to have a written permit from the owner of the land from which the Laurel is taken filed in the nearest town clerk's office and a similar tag attached to the Laurel in transit. Now I say effect *this* compromise by speaking and sending literature to the State Granges,—urge all having wild land or pastures where the Laurel is unwelcome to *apply forestry* to their Laurel and instead

of having it devastated in the usual manner, cut one portion one year, another the third and by a triennial rotation they will have a better crop with large smooth salable leaves and at the same time we may both *see* and gather Laurel. In addition, I urge every land owner in the state to secure as large a planting as possible of this beautiful shrub, for a partly shaded bank or other suitable nook in the home grounds. So shall our State Flower not only be preserved but become a part of the home surroundings.

I cite the Laurel as an example only; there are native plants by the score that may be brought into safety. We have here at Fairfield established a ten-acre sanctuary for song and other birds, for though we have excellent bird laws and faithful wardens, it is impossible to control, above a limited point, the unfenced wild.

Birdcraft Sanctuary, *fenced with cat and climb proof* wire, threaded by wild trails and watered by some natural springs united in a natural pond dotted by islands, is proving a most satisfactory refuge for even the shyest songsters and not a few Game Birds. Our next step is to make it a *wild flower sanctuary* as well.

Thirty odd species of berry and seed-bearing plants, beside many that make only for beauty, we found bird-sown in the spot when it was taken over from being a "calf pasture"—a type of land every country explorer knows well. In a vagrant sort of fashion we have gathered up and transplanted such wild plants as enhanced and supplemented the natural beauty of the place, but now we are planning to do more, to prepare special nooks with special soils and set about systematically to gather those wild plants and ferns that, by means of the reclamation of land and the pervasion of the "back to nature" squads of automobilists are surely doomed.

Literature is sometimes a bad thing, in lieu of being protective, for only last summer I heard of a group of people starting upon a tour for digging wild plants in quantity to supply a purveyor of such things, the location having been discovered *through a leaflet asking people not to disturb this particular plantation!*

At Birdcraft Sanctuary last season, we held an exhibition of wild flowers, grasses and ferns every Sunday afternoon, arranged in the main room of our little cottage museum, and we endeavored to have the Warden of the Sanctuary give brief information as to what might be freely gathered and what should be left untouched. Next season we expect to prepare small folders listing the pickable and the "hands off" species, distributing these to our visitors and also sending them to the Tea Houses in the State.

We are asking our friends to help in making this Sanctuary representative of our State Flora. If any one who reads this paper knows of a patch of flowers or ferns that is doomed, will he not remember our Sanctuary and give us a chance, by either telling us of it, or better yet, carefully boxing it with a good bit of its native soil and sending it to Birdcraft Sanctuary, Fairfield, Conn., in care of Mrs. J. O. Wright, Director?

Fairfield, Conn.

Wild Plant Conservation in Connecticut, A Suburban State

R. C. BENEDICT

The problems of wild plant conservation vary according to the type of region concerned. Vermont's, as discussed in a previous article,* was one of a ruralstate threatened with the depletion if not the extinction of the rarities of its forests and mountains through their exploitation by commercial collectors of living plants. According to reports which have come to me, the Vermont "game law" of 1921 has already accomplished the desired result of restricting the activities of the collectors. Enforcement could be directed against a few known individuals, and was therefore comparatively simple. It will be interesting now to watch the progress of natural restocking.

Mrs. Wright's article presents the problem of a state with a large urban and suburban population. Connecticut has its wild places, notably in Litchfield and Windham counties, but on the whole, its problems are different from those of Vermont. Connecticut is predominantly settled; its wildness is a matter of hills and woods; Vermont's is that of forests and mountains. Connecticut is within automobile radius of New York and Boston; a large region is inhabited by New York commuters. The dangers to wild plant life in Connecticut are correlated with its character as a residence and industrial state, a state of extensive automobile traffic. It has practically passed beyond the stage where it is an important source of living plants of rare wild species for the commercial plant trade. Such rarities as it has like the mountain spleenwort, the lip fern, the climbing fern, etc., occur perhaps in single localities, guarded by

* Game laws for ferns and wild flowers. Am. Fern Journal **12**: 33–45.

their very rarity from the commercial collector. They should, of course, be given every possible protection, if feasible, in sanctuaries like the one at Fairfield.

Connecticut's main problem, however, may be said to be typified in the protection of its state flower, the laurel. It has a law relating to the laurel, as well as to the climbing fern. Indeed, Connecticut deserves recognition as the pioneer state in the development of game laws for plants. (See appendix to this article.) But in the case of the laurel as with the flowering dogwood we are faced with a condition which laws alone will not remedy. We cannot as wild plant conservationists sit back satisfied merely to try to *restrict* the enjoyment of wild beauty like that of the laurel to those able to maintain an estate, or to those able to travel far by automobile, or visit in some favored region.

A state flower should be available to all. Nature produces laurel rather abundantly. Let man learn how, and then raise it in large plantations for commercial use. Surely there should be someone in Connecticut interested enough in its State flower to back the experimental study of its propagation, either at the State agricultural college or under private auspices. Make the raising of laurel from seed as simple as raising rose-bushes and it should be possible to repopulate the roadsides with laurel as the railroad company has planted its embankments with climbing roses. Why not a state laurel nursery as well as a pine nursery, or a fish hatchery for the free supply of small game fish? The laurel of some quiet pasture or valley is one of the strongest memory bonds of the Connecticut visitor or descendant. Grow it for export. Fill the cities in June with its wonderful bloom. Produce all that New York will take. Give this American plant a chance to take its rightful place as the peer of any of the florist's present stock.

Education in the enjoyment of the beauties of nature, constructive study to make these beauties more widely available, the protection in sanctuaries and by legal restrictions as far as needed of such plants as are so rare and difficult to grow as to render them liable to extinction: these, it seems to me, constitute the specific lines of action needed in Connecticut.

BROOKLYN BOTANIC GARDEN.

APPENDIX. CONNECTICUT STATUTES RELATING TO THE CONSERVATION OF WILD PLANTS.

GENERAL STATUTES, 1918, § 6274. WILFUL INJURY TO STRUCTURES, TREES, VEGETABLES, AND OTHER PROPERTY. Every person who shall wilfully injure any tree or shrub standing upon the land of another, or injure or throw down any fence, trellis, framework or structure on the land of another, or shall wilfully cut, destroy or take away from the land of another, any creeping fern, crops, shrub, fruit or vegetable production, shall be fined not more than one hundred dollars or imprisoned not more than twelve months or both.

PUBLIC ACTS, 1921, CH. 270. EVERGREEN TREES, FOLIAGE AND TRANSPORTATION OF THE SAME.

SECTION 1. Any person who shall take from the land of another in this state the whole or part of any pine, spruce, hemlock, fir or other evergreen tree with needle-bearing branches thereon without having in his possession or having filed with the town clerk of the town wherein such land is situated the written permission of the land owner or his agent to take the whole or any part of any such tree, or who shall transport any such tree in such condition which is not marked as provided by section two of this act shall be deemed to have violated the provisions of this act.

SECTION 2. Section 6275 of the general statues as amended by chapter 285 of the public acts of 1919 is amended to read as follows:—Any person who shall take any Kalmia latifolia, commonly known as mountain laurel, or any ferns, vines or foliage branches of trees or shrubs from the land of another, to be sold or offered for sale as a commodity, without having obtained and filed with the town clerk of the town in which the land is situated, the written permission of the owner or lessee, or his duly authorized agent, of the land whereon the same was taken, shall be fined not less than fifty dollars nor more than one hundred dollars in each case, and one-half the amount collected as a fine shall be paid to the person upon whose information the proceedings were instituted. The owner, occupant or person in charge of the land as such authorized agent, or such person as he may command to assist him, may arrest any person violating any provision of this section, and forthwith take such person before some proper authority, who shall, upon complaint of the prosecuting officer try such person. The owner, occupant, person or agent in charge of the land, arresting any person pursuant to the provisions of this section shall be

entitled to the fees allowed by section 2252 of the general statutes to constables for similar services, which fees shall be taxed as costs by the court before which the trial is had. Every bale, box, package or load containing more than twenty pounds of Kalmia latifolia or any ferns, vines or foliage branches taken from the land of another transported upon the highway or offered for transportation to any common carrier shall be legibly marked by tag, stencil or otherwise to indicate the name and address of the owner or lessee of the land from which such foliage was taken, and the name and address of the person who gathered the same. The presence in transit, either upon the highway or in the possession of any common carrier, of any such bale, box or package not so marked, shall be prima facie evidence of a violation of the provisions of this section by the person who gathered the contents of such bale, box or package. Any tree warden or officer authorized to serve criminal process may enforce the provisions of this section and may inspect and weigh any bale, box or package containing such foliage, but the provisions of this section shall not be construed as authorizing any officer to stop or impede the progress of any train or electric car of any common carrier upon which such foliage may be in transit. No provision of this act shall be construed to apply to any tree, shrub or plant in transit from or growing in any commercial nursery.

GENERAL STATUTES, 1918, § 6276. WILFUL DESTRUCTION OF TRAILING ARBUTUS. Every person who shall wilfully destroy, pull up, tear up, or dig up, any trailing arbutus from the land of another, or who shall sell, expose for sale, or purchase, or have in his possession, any trailing arbutus with the roots or underground stems attached, taken from land not owned or occupied by him, shall be fined not more than twenty dollars.

NOTES ON THE PROGRAM FOR WILD PLANT PROTECTION.—Judged by the continued correspondence, wild plant protection has a wide interest. Dr. Gager's article in Science (Jan. 13, 1923) brought about forty requests for copies of the "Game Laws" reprint, and further correspondence has followed. The Michigan Sportsman has given us an editorial column (10: 17) Jan. 15, 1923.

Mrs. Wright's article and the additional discussion of Connecticut conditions deal with the most difficult kind of conservation, that involving thickly populated regions with abundantly used automobile roads. Ferns are involved as well as flowering plants like laurel though to a lesser extent, since they are less conspicuous.

One hundred extra copies of the first issue of the JOURNAL for 1923 were authorized by the Council and will be distributed to a list of those to whom the "Game Laws" paper has been sent. Our stock of this

is running rather low, but the type plates and cuts have been shipped to Mr. Ricker in Washington for further reprinting during the spring.

A gift of $2.00 from Miss Amey Lillibridge is gratefully acknowledged. Unstated but considerable amounts in the form of postage have been received through the interest of several members who have taken responsibility for the distribution of large numbers of reprints. — R. C. BENEDICT.

"THE FERN LOVER'S COMPANION."[1]—It is nearly twenty years since the day when the appearance of a new fern book was an event of annual or biennial occurrence. And yet, although this book gives evidence of careful reading of current literature, there is not much in it to indicate that the older publications are seriously out of date. However, most of them are out of print, and for this reason and because of its exceptional attractiveness in form and substance the new comer should find an abundant welcome among the present generation of fern students.

The author is a contemporary with Davenport and Robinson, and doubtless the perspective gained by the study of ferns in the days when the literature was scant has enabled him to resist the natural temptation to too great comprehensiveness. The book is well supplied with keys, glossaries, bibliography, biographical notes, check list and indices, and the introduction contains a clear and well illustrated account of fern reproduction. All this in the space of some 230 pages, more than one half of which is given to illustrative matter. It is doubtful if any book has been published so well adapted to lead the beginner quickly and directly to whatever information he requires.

[1] The Fern Lover's Companion. George Henry Tilton, 240 pp., 159 illustrations. Little, Brown & Co., Boston.

Some readers may experience a slight shock on reading in regard to Boott's Shield Fern, "This fern has been thought to be a hybrid between the crested and spinulose ferns, but is now regarded as distinct." But in general controversial matters are avoided, or, in case of question, both sides are presented impartially. The common names are used, followed by the scientific names with liberal synonymy. The Ostrich Fern, for example, has all four of its generic titles, as also have the wood ferns.

Mr. Tilton aptly characterizes his book as "unpretentious, but progressive." It is moreover an exceedingly dainty and attractive specimen of the bookmaker's art, testifying to the author's genius for securing the cooperation of others, not only fern students, but photographers, draftsmen, engravers, printers and binders.

The flexible covers of dark green leather, the velvety lustre of the paper, the clear print and abundance of excellent illustrations will add charm even to the most enchanting of subjects as the admirably condensed descriptions and appropriate comment will add illumination to its obscurities. True to its name and subtitle, the fern lover will find it a pleasant companion and a safe and dependable guide.—E. J. W..

American Fern Society

Mrs. Nellie F. Flynn, a member of the Society since 1910, died at her home in Burlington, Vermont, Dec. 9, 1922. She was born in 1862 at Peru, Vt., the daughter of Albert and Sarah Davis Waite. Most of her early life was spent at Dorset: after her marriage to Mr. John J. Flynn, she came to Burlington. There, for 39 years, she had lived a life full of varied and active interests, both public and private, and had come to occupy "a unique position in the affairs of the city . . . the friend of every movement for the uplifting and better-

ment of the citizens of her state." She had served for nearly five years as one of the park commissioners in Burlington, especially concerned with the establishment of playgrounds for children.

To us, of course, Mrs. Flynn was best known and, aside from the personal loss to her fellow-workers, will be most missed, as a botanist. She had collected widely, not only in Vermont, but in the course of vacation journeys to many different regions. Her name appears in Mr. Bicknell's very thorough and exhaustive Flora of Nantucket as the collector of several species not otherwise known to him; and Bermuda, Cuba, California, Florida, and parts of Europe were represented in her herbarium. She had published an excellent flora of the vicinity of Burlington and had contributed occasional notes to botanical journals. At the time of her death she was chairman of a committee of the Vermont Botanical Club engaged in revising the published Flora of that state. She had been for many years treasurer and recently secretary also of that club.

Report of the Treasurer for 1922

GENERAL FUND

Received		
On hand Jan. 1		$313.64
Received membership dues 1920	$5.00	
" " " 1921	51.50	
" " " 1922	356.85	
" " " 1923	39.00	
" " " 1924	2.00	
Total Dues Received	$454.35	$454.35
Received Subscription,		
Journal, 1922	64.90	
Journal, 1923	13.16	
Total subscriptions received	78.06	78.06
Misc. Receipts advertising	4.00	
Interest	2.10	
Collection fees	.20	
Total Misc. Receipts	6.30	6.30
Carried forward		$538.71

Brought forward	$538.71	
Gifts for Illustrating Fund	16.76	
Gifts for Special Reprint Fund	60.50	
Sales Back Numbers, to Emergency Fund	62.87	
Total Receipts in 1922	678.84	678.84
Grand Total		$992.48
Paid Out		
Treasurer's Expenses	15.00	
Secretary's Expenses	8.29	
JOURNAL Expenses. From Budget	366.65	
Illustrating Fund	16.26	
Total Journal Cost,	382.91	382.91
Balance 1921 Membership Campaign Expenses		15.00
Special Reprint acct. paid out		86.37
Society, Total Expenses		507.57
Transfer to Permanent Fund, Council Order 39		100.00
Total Paid Out from General Fund		607.57
Balance on Hand Dec. 31,		384.91
		$992.48

This Balance on Hand is made up as follows.

EMERGENCY FUND

On Hand Jan. 1,	$101.34	
Rec'd sale Back numbers	62.87	
Total received	164.21	
Transferred to Permanent Fund	100.00	
Balance Forward	64.21	64.21

ILLUSTRATING FUND

On Hand Jan. 1,	12.43	
Gifts Received,	16.76	
Total Received	29.19	
Paid for Illustrations,	16.26	
Balance Forward,	12.93	12.93

SPECIAL FUND FOR REPRINTING ARTICLE ON FERN CONSERVATION

Appropriation by Council, Order No. 41	50.00	
Gifts for this purpose	60.50	
Total Received	110.50	
Paid out on this account	86.37	
Balance Forward,	24.13	24.13
Special Council Order for Cataloging Society Herbarium		25.00
Amount not appropriated, subject to Council Order		258.64
Balance of General Fund		$384.91

Unexpended Balances of annual Budgets are returned as part of this general fund.

SPECIAL PERMANENT FUND

Balance on Hand Jan. 1,	264.67
INTEREST RECEIVED	17.84

Transfer from General Fund, Council Order No. 39 ..	100.00
Balance on Hand,.....	$382.51
Any estimate of the Net Worth of the Society would include the above balances of, General Fund.....	$384.91
Permanent Fund...	382.51
Value of Journals on hand in the care of the Editors Not less than and insured for,.....	1000.00
Total assets.....	$1767.42

There are no unpaid bills.

This estimate of net worth is only partially correct as it does not include the value of the Herbarium. It might be well to attempt to include this and all other assets next year, and try to show net worth from year to year.

Respectfully submitted,
J. G. UNDERWOOD, *Treasurer*.

The Secretary has received notice of a summer meeting of the American Association for the Advancement of Science to be held at Los Angeles, Cal., Sept. 17–19. Though we are planning no meeting of our own, our members will be privileged to attend the meetings of the Association. Arrangements are in charge of Mr. W. W. Sergeant, Golden Gate Park, San Francisco. Dr. D. T. MacDougal, Desert Laboratory, Tucson, Ariz., would like to hear of any eastern scientists who are likely to be in California in September.

The Society has received in exchange for the JOURNAL a copy of Christ's "Farnkräuter der Erde" which is available for lending to any of our members who read German.

Changes of address:—

Fellows, Dr. Dana W., 150 Park Ave., Port Richmond, N. Y.
Strattan, Mrs. G. W., 518 Franklin Ave., Wilkinsburg, Pa

New Members:—

Fisher, George L., 713 Leland Ave., Houston, Tex.
Gray, Rev. Fred W., Cass, W. Va.
Hutchinson, Mrs Susan W., 906 South New Hampshire Ave., Los Angeles, Cal.
Kamm, Mrs. Minnie Watson, 263 Windermere Road, Walkerville, Ontario.
Sim, Robert J., Bureau of Plant Industry, Dept. of Agriculture, Harrisburg, Pa.
Wells, Percy E., Maple, Ontario, Canada.

Mr. Nathaniel T. Kidder has become a life member.

Members of the American Fern Society are cordially invited to attend the meetings of the Vermont Botanical and Bird Clubs to be held in Middlebury, Vermont, beginning June 29th.

Members will assemble at the Bread Loaf Inn, 15 miles from Middlebury, on the 29th, remaining there until Sunday night, and then adjourning to the Addison House at Middlebury for two or three days.

Rates at the Bread Loaf Inn will be $4.00 up per day, plus a fee of $4.00 for transportation for the round trip from the Middlebury Station to the Inn. Rates at the Addison House in Middlebury village will be $3.75 without bath and $4.25 with bath.

Any planning to attend should notify Prof. D. W. Mills, 115 Main St., Middlebury, Vermont. The richness of the Vermont fern flora is almost proverbial; it is hoped that a good number of our members will find it possible to attend.

Owing to the destruction by fire of the Lorillard Mansion in the New York Botanical Garden, the Wild Plant Conservation meeting, announced in the last number of the JOURNAL, will be held at the Brooklyn Botanic Garden. Those planning to attend should

note this change of place; the date, May 23rd, remains the same.

The report of the Curator was received too late for inclusion in this number. It will appear in no. 3.

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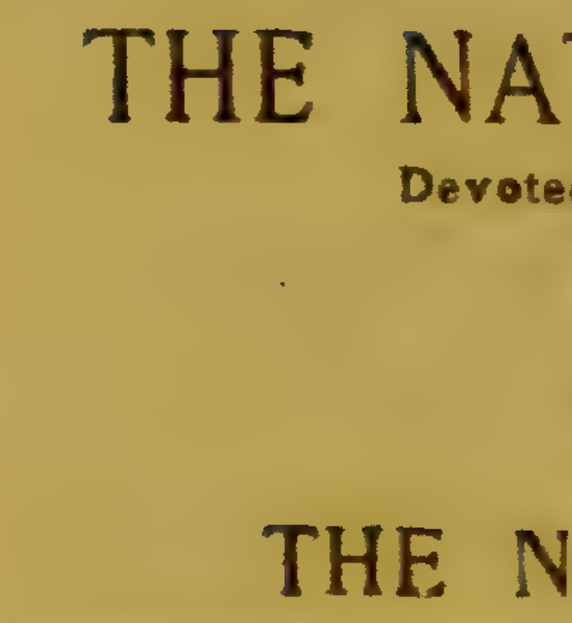

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Vol. 13 July–September, 1923 No. 3

American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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OCT 6 1923

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Council for 1922

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American Fern Journal

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A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different localities.

American Fern Journal

Vol. 13 JULY–SEPTEMBER, 1923 No. 3

How to Distinguish the North American Species of Equisetum[1]

John H. Schaffner

KEY TO THE SPECIES, VARIETIES, AND HYBRIDS OF EQUISETUM IN NORTH AMERICA, NORTH OF MEXICO

Arranged for the identification of both fertile and sterile shoots

1. Aerial shoots with chlorophyll, at least the branches green. 2.

1. Aerial shoots with little or no chlorophyll, appearing brown or flesh-colored; sometimes with chlorophyll in the sheaths or with chlorophyll-bearing branches when fully matured. 16.

2. Internodes of the main stem with a central cavity, if solid the teeth not as below. 3.

2. Aerial stems solid, low, small, tufted, not with whorls of branches, usually 6-grooved; sheaths with 3 bicarinate or somewhat quadricarinate teeth. the teeth not differentiated from the sheath and not deciduous; evergreen; cones with a rigid point. Fertile and sterile stems. *E. scirpoides.*

3. Stems usually not branched above ground unless the plants are injured, or the branches few, irregular and sporadic; stomata in regular rows; teeth of the sheaths or their bristle-tips usually soon deciduous but several species with persistent teeth; cones with or without a point. 4.

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[1] Continued from page 40.

[Vol. 13, No. 2 of the Journal, pages 33-66, plate 2, was issued May 11, 1923.]

3. Stems usually much branched, with several to many regular whorls of branches, rarely with only few sporadic branches, annual; stomata in broad bands or scattered in the grooves of the internodes, or only on the sheaths; teeth of the sheaths persistent; cones not apiculate. 10.
4. Teeth of the sheath persistent or only their bristle-tips deciduous, white-margined, not sharply differentiated from the sheath; sheath-segments and lower part of teeth distinctly quadricarinate; stems low and slender, usually 5-10-grooved, rigidly erect in tufts, usually evergreen; central cavity less than one-half the diameter of the internode; cones apiculate. Fertile and sterile shoots. 5.
4. Teeth soon deciduous, sharply differentiated from the sheath; main stems usually tall, 10-many-grooved, with a central cavity occupying more than half the diameter of the internode. 6.
5. Ridges of the internodes prominently biangulate; bristle-tips of the teeth deciduous; cells of the sporangium wall with spiral thickenings; spores normal. *E. variegatum.*
5. Ridges of the internodes biangulate; tips of the teeth persistent; cells of the sporangium wall without spiral thickenings; spores largely abortive. *E. variegatum jesupi* (probably *E. variegatum* × *E. praealtum*).
5. Ridges of the internodes rounded, not biangulate; teeth of the sheath with filiform deciduous points. *E. variegatum nelsoni.*
6. Sheaths cylindrical, short, appressed, or only slightly dilated when young, at first green but soon turning black or gray, commonly gray with black bands above and below, often split in age; stems usually very rough, evergreen; cones apiculate. 7.
6. Sheaths more or less funnel-shaped, elongated and green, the limb sometimes incurved, normally with a narrow black band at the top, sometimes the lower sheaths with bands of gray and black below; stems evergreen or annual; cones with or without a point. 8.

7. Ridges of the internodes with one row of tubercles; sheath-segments without a central groove or sometimes with a minute groove, normally tricarinate. Fertile and sterile shoots. *E. praealtum.*
7. Ridges of the internodes with two rows of tubercles, more or less biangulate; sheath-segments usually with a deep central groove, normally quadricarinate. Fertile and sterile shoots. *E. hiemale.*
8. Stems evergreen, smoothish, usually large, not with a rosette-like cluster nor with prostrate sterile shoots around the base of the erect fertile shoots; cones tipped with a rigid point. Fertile and sterile shoots. *E. laevigatum.*
8. Stems annual, very smooth or very rough, sometimes with rosette-like or prostrate branches around the base of the fertile shoots; cones rounded or the tip merely acute. 9.
9. Not with numerous basal sterile shoots around the fertile shoot; stems usually very smooth, with cross bands of silex; limb of the long green sheath dilated upwards with a narrow black band, not incurved or only slightly so, the teeth normally soon deciduous. Fertile and sterile shoots. *E. kansanum.*
9. Usually with a cluster or rosette of small, branched, spreading or horizontal sterile shoots around the base of the main erect shoots; stems very rough with cross-bands of silex; limb of the rather short sheath strongly incurved in age, with a narrow black or brown band, the teeth persistent or tardily deciduous. Fertile and sterile shoots. *E. funstoni.*
10. Ridges of the usually simple branches deeply grooved as also the sheath segments which are strongly bicarinate, hence the internodes with twice as many ridges as the accompanying sheath teeth; branches terete and solid, mostly with 6–8 ridges; sterile stems ivory white or brownish, 2–10 ft. high; fertile stems brown, usually without branches; cones 2–3 in. long. Sterile and occasional fertile or semi-fertile shoots. *E. telmateia.*
10. Ridges of the branches not grooved, and thus sheath teeth as many as the ridges of the internode, the

sheath segments unicarinate or rounded on the back, or if with a slight central groove, then the main stem green and the branches hollow. 11.

11. Branches hollow, terete, usually simple; both sterile and fertile stems green; plants of wet soil or growing in water, sometimes without or with only sporadic branches. 12.

11. Branches solid, mostly sharply 3–4-angled, nearly always present, simple or compound; fertile stems brown and at first without branches, soon withering or developing green branches when mature; usually in ordinary moist or dry situations. 14.

12. Sheaths of the main stem usually appressed, 15–20-toothed; stems usually many-grooved, with a large central cavity, 2–4 ft. high, usually not branched below or at the top, the branches comparatively short, sometimes without branches. Fertile and sterile shoots. *E. fluviatile.*

12. Sheaths of the main stem loose and somewhat dilated, usually less than 10-toothed; stems ½–1½ ft. high, slender, 6–10-grooved, usually bushy below, the branches usually comparatively long; central cavity usually not over one-half the diameter of the internode, often much less. 13.

13. Central cavity very small; cones long and the spores normal; cells of the sporangium wall with spiral thickenings. Fertile and sterile shoots. *E. palustre.*

13. Central cavity usually about one-half the diameter of the internode or less; cones short or only slightly developed; cells of the sporangium wall without spiral thickenings; spores abortive, commonly without elaters. *E. litorale* (semi-sterile shoots of *E. palustre*, and hybrids—probably *E. palustre* × *E. arvense* or *E. fluviatile* × *E. arvense.*

14. Branches of the whorls prominently compound, often curving downward, especially those on the fertile shoots; teeth of the sheaths of the main stem united into 3 or 4 lobes, bright reddish-brown; old fertile shoots developing green branches, only the tips withering; teeth of the branches acuminate or awl-pointed. Sterile and old fertile shoots. *E. silvaticum.*

14. Branches of the whorls mostly simple or if somewhat irregularly branched not curving down gracefully; teeth of the sheaths of the main stem not cohering into 3 or 4 broad lobes but more or less distinct and subulate. 15.

15. Teeth of the sheaths of the branches obtuse or acute, deltoid in shape; branches of both sterile and fertile shoots commonly 3-angled and their sheaths 3-toothed; fertile shoots producing branches at maturity, only the tips withering; northern. Sterile and old fertile shoots. *E. pratense.*

15. Teeth of the sheaths of the branches acuminate or with awl-shaped tips; branches 3–6-angled, commonly 4-angled and their sheaths commonly 4-toothed; fertile shoots rarely producing branches at maturity, usually soon withering; general in distribution. Sterile and rarely fertile and semi-sterile shoots. *E. arvense.*

16. Fertile stems usually 1–2 ft. high, robust, the internodes usually without stomata, the sheaths including the 20–40 long teeth 1½–2 in. long; cones 2–3 in. long; sheath teeth of the branches of the sterile shoots one-half as many as the ridges of the internodes. *E. telmateia.*

16. Fertile stems usually ½–1 ft. high, comparatively slender, the sheaths including the 7–15 teeth ¾–1½ in. long; cones rarely 1½ in. long; ridges of the branch internodes equal in number to the sheath teeth which are usually unicarinate. 17.

17. Teeth of the sheaths of the main stem cohering into 3–4 broad lobes; bright reddish-brown; fertile stems soon developing whorls of compound branches; whorls of the sterile stems also compound. Young fertile shoots. *E. silvaticum.*

17. Sheaths with short subulate teeth, which are little or not at all coherent when the stem is expanded; branches of the sterile shoot simple or only slightly compound. 18.

18. Teeth of the pale sheath brown, white-margined; fertile stems soon becoming of a greenish tinge, usually showing whorls of incipient branches or buds under the sheaths before the cones mature, only the tips withering; teeth of the delicate

branches usually 3, acute or obtuse; northern. Young fertile shoots. *E. pratense.*

18. Teeth of the yellowish-brown sheaths long-pointed, dark-brown; sheaths occasionally with some chlorophyll; fertile stems brownish or flesh-colored, very rarely showing whorls of branches or buds under the sheaths, the entire shoot withering at maturity; branches of the sterile shoot simple or somewhat compound, 3–6-angled, commonly 4-angled, the sheaths commonly with 4 acuminate or awl-shaped teeth; general in distribution *E. arvense.*

LIST OF NORTH AMERICAN SPECIES ARRANGED IN PHYLETIC SERIES

1. E. LAEVIGATUM A. Br. Smooth Scouring-rush.
2. E. PRAEALTUM Raf. Great Scouring-rush.
3. E. HIEMALE L. Rough Scouring-rush.
4. E. VARIEGATUM Schleich. Variegated Scouring-rush.

4a. E. VARIEGATUM JESUPI A. A. Eat. (Probably *E. variegatum* × *E. praealtum.*)

4b. E. VARIEGATUM NELSONI A. A. Eat.

5. E. SCIRPOIDES Mx. Dwarf Scouring-rush.
6. E. KANSANUM Schaffn. Kansas Scouring-rush.
7. E. FUNSTONI A. A. Eat. Funston's Scouring-rush.
8. E. FLUVIATILE L. Water Horsetail.
9. E. PALUSTRE L. Marsh Horsetail.

9a. E. LITORALE Kuehl. (Includes semisterile shoots of *E. palustre* and hybrids, probably *E. palustre* × *E. arvense* or *E. fluviatile* × *E. arvense.*)

10. E. SILVATICUM L. Wood Horsetail.
11. E. PRATENSE Ehrh. Meadow Horsetail.
12. E. TELMATEIA Ehrh. Ivory Horsetail.
13. E. ARVENSE L. Field Horsetail.

COLUMBUS, OHIO.

Notes on American Ferns—XIX[1]

William R. Maxon

Polypodium thyssanolepis A. Br.—Diminutive specimens of this extremely variable species, collected at Fort Davis, Texas, August 26, 1913, have recently been received from D. M. Andrews. Though common throughout a large part of tropical America, *P. thyssanolepis* has hitherto been known from the United States solely upon specimens collected in the Huachuca Mountains, Arizona. Like the latter, the present plants have the fronds only scantily scaly beneath, in marked contrast to tropical material. As to small size they are matched by part of the specimens distributed from Chihuahua by Pringle under no. 443.

Selaginella Standleyi Maxon.—At the time this species was described[2] it was known only from a single collection from Alberta (*Brown* 95) and an extensive series of specimens collected in Glacier National Park, Montana, chiefly by Mr. Standley. Its range must now be extended to include British Columbia and Colorado. From British Columbia specimens were collected by Holway and Butters in August, 1904, the exact locality being Yoho Valley, altitude 2,400 meters; on "rocky slopes near Yoho Lake," by Titus Ulke, July 25, 1921; and from shale soil at Sentinel Pass, altitude about 2,560 meters, by Titus Ulke, August 25, 1922. During the summer of 1922, also, Ivan M. Johnston collected it in quantity on Pikes Peak, Colorado, at altitudes ranging from 3,390 to 4,200 meters, in the Arctic-Alpine zone. The plants were commonly associated here with *S. densa* Rydb., and grew abund-

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] Smiths. Misc. Coll. **72**[5]: 9. *pl. 6.* 1920.

antly in various exposed situations, sometimes quite carpeting portions of steep, north-facing, alpine slopes and rocky meadows. The following numbers were collected: *Johnston* 3876, 3881a, 3882a, 3883, 3884a, 3886, 3887, 3888a, 3899, 3901a, 3903, 3905. No. 3882a, consisting of a few small portions mixed with *S. densa*, was collected at 4,200 meters altitude, about 30 meters below the summit of the peak. Though obviously related to *S. Watsoni* Underw., *S. Standleyi* is readily distinguished by the characters emphasized in the original description.

SELAGINELLA WATSONI Underw.—This species, founded on specimens from Cottonwood Canyon, Utah, is well known to extend westward to the high mountains of California (Nevada County to Riverside County), being apparently a common species of rocky slopes and cliffs in the Hudsonian and Arctic-Alpine zones. In Utah it ascends to 3,450 meters. An unexpected extension of range is noted in a Montana specimen recently received from the Forest Service for identification. This was collected on Cornet Mountain, Beaverhead National Forest, at an elevation of 2,700 meters, August 28, 1921, by T. D. Howe (no. 66).

SELAGINELLA LEPIDOPHYLLA (Hook. & Grev.) Spring.—Though commonly given a range from "Texas to Arizona," this species, the well-known "resurrection plant," is omitted from the Flora of New Mexico (1915), by Wooton and Standley, who mention two regions in the southern part of the state where it might be expected to occur. Specimens are now at hand from two parts of New Mexico, these collected early in 1923 by James H. Ferriss. One specimen (no. 1) is from foot-hills of the Magdalena Mountains in west-central New Mexico; the other (no. 2) is from the San Andreas

range, near the south-central part of the state. Both are quite characteristic for the species, agreeing closely with Mexican material.

WASHINGTON, D. C.

A Study of Variation in Polypodium californicum Kaulf.

MARY LOUISE KENDALL[1]

The work on which this paper is based was done in 1921 and gave evidence for justification of the position taken by Eaton (1879) in dividing *P. californicum* into two varieties: a coastal one with coriaceous leaves, var. *Kaulfussii*, and a more common one with thinner leaves and extending from the coast inland, var. *intermedium*. In 1922 Fernald transferred these to varietal rank under *P. vulgare*. While the work herein reported was under way, it seemed as if some such final disposition would be desirable, but it still seems worth while to put on record more detailed figures and measurements for Californian material than have heretofore been available.

The work was carried on under the direction of Dr. Philip A. Munz of Pomona College, to whom I express deep gratitude for his helpful supervision and encouragement. Material was collected in many inland localities centering about the Pomona Valley of Southern California and in the coastal region at San Diego and Laguna Beach. In all, 174 specimens were collected, 50 of these being of the *Kaulfussii* type. Additional material was available in the Baker Herbarium of Pomona College and from the Herbarium of the University of California.

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[1] Contribution from the Botanical Laboratory of Pomona College, Claremont, Calif.

GENERAL OUTLINE OF BLADE OF FROND

The 174 specimens were grouped under sixteen types varying from lanceolate to a broad triangular shape. Because of the difficulty in description these types can best be shown in outline drawings (fig. A).

A

The distribution of these types is as follows:

TABLE 1

Shape	Total frequency	Kaulfussii	Intermedium
No. 1	5	0	5
2	19	4	15
3	12	5	7
4	10	3	7
5	3	0	3
6	6	0	6
7	18	6	12
8	18	5	13
9	33	13	20
10	17	4	13
11	5	4	1
12	9	0	9
13	9	5	4
14	2	0	2
15	4	1	3
16	4	0	4

The most common type was a triangular-ovate blade; next came a broadly lanceolate type, then ovate with acuminate tip and orbicular-ovate. The two varieties show much the same range of variation, with a much greater range of variation than is mentioned in descriptions. In Underwood (1900) the frond is described

as ovate to oblong-lanceolate; Eaton (1879) describes it as ovate or ovate-oblong; Jones (1882) as ovate to oblong-lanceolate. There is no apparent correlation between shape of blade and geographical distribution.

RATIO OF LENGTH TO WIDTH OF BLADE

The size of the blade of the frond is an extremely variable character. The length and width of the blades of 383 fronds on 174 specimens were measured and the ratio of length to width worked out (table 2). This ratio varied from .95 to 2.89; the relative frequency of occurrence of different ratios in the two varieties was essentially alike.

TABLE 2

Ratio	Total Frequency	Kaulfussii	Intermedium
.95	5	0	5
1.05	6	1	5
1.15	9	3	6
1.25	9	3	6
1.35	14	5	9
1.45	22	11	11
1.55	40	11	29
1.65	65	20	45
1.75	54	17	37
1.85	42	9	33
1.95	34	10	24
2.05	26	9	17
2.15	21	1	20
2.25	15	0	15
2.35	9	0	10
2.45	3	0	3
2.55	4	0	4
2.65	3	0	3
2.75	0	0	0
2.85	2	0	2

Specimen no. 71482 of the Herbarium of the University of California has fronds 47.5 cm. long; the longest frond of my collections used in making up table 2 was 27.3 cm.; the shortest was 4.9 cm. The width varied in my specimens from 15.1 cm. to 2.8 cm. The largest measurements given by Underwood (1900) are 23 cm. by 12.5 cm. and by Eaton (1879) 30.5 by 14 cm.

APEX OF THE FROND

The apices of the fronds vary widely, but they may be grouped into three types (fig. B, plate 3): (1) those with a long, narrow middle segment with finely toothed margins; (2) those with marked lobing extending halfway to the rachis; and (3) those that are short and wide and with dentate margins. One and two are common in both varieties; three is occasional in *intermedium*.

MARGINS OF THE PINNAE

Very great differences have been noted in the margins of the pinnae with respect to the depth and arrangement of the teeth. In the various descriptions little attention is paid to this variable character. Underwood (1900) mentions the "finely-toothed pinnae": Eaton (1879) describes the margins as "obscurely or plainly serrate."

The serrate condition of the pinnae is very inconstant; in some the teeth are deep and sharp, and in others it is impossible to see that the pinnae are not entire without the aid of a hand lens. In some of the fronds, the serrate margin is accompanied by curling under and in others by ruffling. The teeth of some pinnae are all approximately of one size, while in others they are doubly serrate, with two or three small teeth on one large one.

The most interesting condition of margin found is the deeply incised type, making the pinnae almost pinnatifid and occurring in specimens from several localities. Howe (1893) mentions and shows a plate of a specimen now in the Herbarium of the University of California, calling attention to the fact that the segments are lobed and cleft instead of being simply serrate. This specimen is classed as var. *intermedium*, but the author calls attention to the fact that it seems to be analogous to Moore's var. *semilacerum* of *P. vulgare*.

C

B

1.

2.

3.

D

Polypodium californicum Kaulf.

B. Tips of fronds. C. Margins of Pinnae. D. Scale.

In my study 22 plants have been found with lobed or cleft segments, occurring in both varieties. Some of these have only the first segments deeply lobed; in others the pinnae of the entire frond are lobed. On the whole there seems to be a tendency toward a pinnatifid condition of the pinnae (see fig. C, plate 3).

TIPS OF PINNAE

In Kaulfuss' description of *P. californicum* given by Eaton (1879) the tips of the segments are described as "retuse." Eaton himself says "obtuse or acute." A survey of the tips of fronds of 125 plants of var. *intermedium* failed to show any retuse tips. Of the basal pinnae, 60 were acute and 65 obtuse, while of the fourth pinnae from the base, 93 were acute and 32 obtuse. Of the 49 plants of *Kaulfussii* studied, 15 had acute basal pinnae and 34 obtuse; of the fourth pinnae 29 were acute and 20 obtuse. This shows the very distinct tendency toward the acute condition in the higher pinnae, especially in the var. *intermedium*, though in a very few cases the lowest pinnae were acute and the upper obtuse.

TEXTURE AND VENATION

Eaton (1879) characterizes var. *Kaulfussii* by the "firm-chartaceous" fronds and the "veinlets regularly forming a single series of narrow, oblique areoles," while *intermedium* has an "herbaceous or membranaceous" frond and "veinlets forming only scattered areoles." He says further, "The texture of fronds from inland localities is rather thinner than in *P. vulgare* and the veins are more easily seen; but plants from the sea-coast, which are evidently similar to those described by Kaulfuss, have a firmer frond, and less conspicuous veins."

The 53 specimens from the coast, with the exception of two from San Diego and one from Laguna Beach,

are of a very different texture from even the thickest collected at inland stations. These three specimens are thin and membranaceous with only scattered areoles and are distinctly of the var. *intermedium*. They were found growing on slopes with plants of var. *Kaulfussii;* of the other 50, 41 are very evidently *Kaulfussii* with a firm-chartaceous or almost leathery texture and the veinlets forming regular lines of areoles. The other nine coastal plants have the leathery fronds, but the veinlets do not anastomose as regularly as in the 41; especially towards the apex of these fronds and towards the tips of the pinnae do the veinlets fail to form areoles.

The texture of the inland specimens varies from very thin and almost translucent, in damp situations, to thick and crisp, especially in dry places. In many of the inland specimens the veinlets form areoles quite as regularly as in *Kaulfussii*, though in some of the thickest, areoles were found most rarely; in three of my inland specimens no closed areoles were found at all. Two of these were rather thin-leaved with the pinnae almost pinnatifid; the other was thick-leaved with the veins so arranged that one or two areoles were almost, but not quite, closed. The whole situation shows a close approach to conditions in *P. vulgare;* cf. Christ (1897) and Fernald (1922). The latter refers to the variety *Kaulfussii* a specimen from San Bernardino; I have seen no plants very far from the coast which seemed in texture to belong to this variety.

The distribution of *intermedium* specimens as to texture and venation is as follows:

TABLE 3

Texture	Closed areoles	Number
Thin	Regular	32
Thick	"	20
Thin	Scattered	40
Thick	"	29
Thin	None	2
Thick	"	1

It would seem that the peculiarity of texture is the most distinctive difference between the two varieties. The difference in shape of pinnae mentioned by Eaton (1879) is not at all constant, and the venational differences are very irregular. The var. *Kaulfussii* is the more common form at the coast, while *intermedium* is that of the inland and shows a close approach to *Kaulfussii* when its fronds are thickest.

WIDTH OF PINNAE

The width of the basal and fourth pinnae of 174 specimens was measured one inch from the rachis (table 4). The first pinna was found to vary from 0.5 cm. to 1.8 cm. and the fourth from 0.3 to 2.0 cm. The general average for the basal pinnae was 1.1 and for the fourth less than 1.0 cm. The pinnae seemed to vary independently; sometimes the lower one being wider and sometimes narrower than the fourth. Curves made for the two varieties show about the same range of variation.

TABLE 4

Width in cm.	1st Pinna	4th Pinna
0.3	0	1
0.4	0	2
0.5	1	2
0.6	0	9
0.7	8	20
0.8	16	24
0.9	32	43
1.0	25	30
1.1	33	12
1.2	28	20
1.3	10	7
1.4	7	2
1.5	9	0
1.6	3	0
1.7	0	0
1.8	1	1
1.9	0	0
2.0	0	1

SINUSES BETWEEN PINNAE

Drawings of the first sinus from the base and the third from the tip of one frond from each of the 50 *Kaulfussii* and the 124 *intermedium* plants were made. The same general type of variation was found in both forms; of the lower sinuses, about one-third are rounded on both sides and the others are either angled above, below, or on both sides. The upper sinuses were angled without exception.

PLACING OF PINNAE

Eaton (1879) says "the lower ones (pinnae) are more frequently opposite than in *P. vulgare*" and "toward the apex of the frond, the segments are alternate." The same author (1880) says "the lower ones mostly opposite; . . . the upper ones often opposite." Though more of the pinnae at the base of the frond give the appearance of being placed opposite than alternate, an examination of the midrib shows that none of these are exactly opposite. The midribs come off the rachis usually at different angles and at a slightly different level. Of the 174 specimens, 92 had the basal pinnae almost opposite and 82 were distinctly alternate. At the tip a very few were nearly opposite. No difference could be noted in the two varieties.

NUMBER OF PINNAE

The pinnae on 420 fronds from 174 specimens were counted and the number was found to be very variable, ranging from 7 to 47 per frond. The most common frequency for the total group as well as for that part from inland was 23.5, for the coastal 27.5. The 98 fronds of coastal plants ranged from 13 to 37 pinnae per frond; table 5 shows the distribution of the three groups.

TABLE 5

Number of Pinnae	Total Frequency	Kaulfussii	Intermedium
7– 8	1	0	1
9–10	0	0	0
11–12	14	0	14
13–14	26	2	24
15–16	26	2	24
17–18	41	7	34
19–20	46	9	37
21–22	56	12	44
23–24	58	10	48
25–26	41	11	30
27–28	33	15	18
29–30	30	11	19
31–32	14	7	7
33–34	13	5	8
35–36	14	6	8
37–38	2	1	1
39–40	1	0	1
41–42	2	0	2
43–44	1	0	1
45–46	0	0	0
47–48	1	0	1

NUMBER OF SORI PER PINNA

In studying the number of sori per pinna only fertile fronds were used and the number was 156. The fourth and eighth pinnae from the base were used on each frond; and the figures resulting are shown in table 6. A special study made of sorus number in the var. *Kaulfussii* showed about the same range of variation as for *intermedium*. The grouping of sori in the fourth pinna was very irregular and variable, running from none to 38; the eighth pinna had still wider variation, from 0 to 40. In several specimens a tendency toward a double row of sori on each side of the midrib was noted; it was accompanied by complicated venation and very much divided margins.

TABLE 6

Number of Sori	4th Pinna	8th Pinna
0	18	1
2	5	1
4	6	4
6	3	5
8	5	10

Number of Sori	4th Pinna	8th Pinna
10	6	7
12	13	13
14	3	13
16	7	13
18	10	19
20	15	13
22	17	10
24	10	13
26	11	11
28	8	8
30	7	4
32	4	4
34	5	2
36	0	3
38	2	1
40	0	1

THE SCALES OF THE RHIZOME

Eaton (1879) says the root-stock is "creeping with the upper side exposed to the air, as in *P. vulgare*, and is chaffy with very similar scales" and "with light brown scales." He describes the scales of *P. vulgare* in greater detail: "ovate-acuminate, brownish chaffy scales, peltately attached near the base. The middle portion of the scales and the slender acumination are often darker than the border, which is irregularly erose-ciliate or denticulated." In this study it has been found that the shape and size of these scales are very variable; some have narrow bases, others are broadly ovate; some have short tips, though always tapering, others are long and slender.

The edge of the scales is always irregular. The color is given to the scales by the darker portion in the middle, extending from around the point of attachment toward the tip and is due to the thick cell walls of this portion. The scale color is variable, ranging from straw color, through bright reddish brown to dull brown, dark brown and almost black, especially in old rhizomes.

In some specimens, the scales are scattered on the rhizome, but most are close set; this seems to be due in some measure to age, but not entirely so. In some

cases the rhizome was very shaggy, particularly in *Kaulfussii*, while in *intermedium* many had smooth-lying scales, apparently especially on unshaded rocks.

Twelve specimens had tufts of hairs near the point of attachment of the rhizome scales; these specimens came from several localities and included both varieties. The hairs seem to come out of either side of the scale and in appearance closely resemble the rhizoids of a moss. Fig. D, plate 3, shows a scale and some hairs.

SUMMARY

1. *Polypodium californicum* Kaulf. is an extremely variable fern, the variations in each character studied surpassing those given in published descriptions.

2. A careful study shows a close approach to *P. vulgare*.

3. There are two quite distinct groups: the var. *Kaulfussii* D. C. Eaton and var. *intermedium* (Hook. & Arn.) D. C. Eaton, the former occurring only in a narrow strip along the coast and the latter to some extent along the coast but more commonly inland. In general, these two forms exhibit the same variations and vary within the same limits, so that they can certainly not differ in more than varietal amount. The only distinctive features observed were: (1) a leathery texture for *Kaulfussii*, approached by *intermedium* only when growing in very exposed places, (2) a tendency to more definitely closed areoles in the former, although this tendency is frequently met in the latter.

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Claremont, Calif.

Is Botrychium Dissectum a Mutant?

E. W. Graves

I have been very much interested in the discussion that has taken place concerning *Botrychium obliquum* and *B. dissectum* in the pages of the Fern Journal. What I have to say may not throw much light on the subject and may make greater confusion concerning the already unsettled question; but there seems to be one point bearing on the matter which has not been brought out.

From the data presented by others, I take it that as a rule they have found the ferns in question growing together. That is, where one finds *B. obliquum*, one usually finds *B. dissectum* if he looks for it. Even in Mr. Deam's case, where there was a colony of *B. dissectum*, he found at least one *B. obliquum*. That may hold good in the northern states, but will not in the South.

In my ten years spent in Alabama and Georgia I have found perhaps hundreds of plants of *B. obliquum*, but have never found one of *B. dissectum*—and I have searched carefully by the hour, crawling on my hands and knees to be sure that I overlooked nothing. In no case have I found *obliquum* abundantly, but sparingly, scattered in small colonies of from four or five to a dozen plants.

Mohr's *Plant Life of Alabama* does not give *B. dissectum* for the state. In the lists of ferns reported in the *Fern Bulletin* and FERN JOURNAL for the states of Florida, Georgia, Louisiana, and Texas, in not one case do we find *B. dissectum* reported. However, we do find it reported from Vermont, New Hampshire, Maine, Connecticut, Pennsylvania, New York, and New Jersey.

The objections made by Prof. Hopkins concerning the determination of the species in question of course will have some bearing on the subject. But I am positive that all the plants which I have discovered in Alabama would be considered true *obliquum*. I have lately referred to my herbarium and in no specimen do I find the requirements called for to class it as *B. dissectum*.

Concerning the laciniations of *B. dissectum*, I have in mind another fern which varies quite as much in its blade division, *Asplenium pinnatifidum*. I have been fortunate in being located for eight years where that fern was really abundant, and in the examination of hundreds of plants I have found a wide variety in leaf cutting. I have specimens in my herbarium which are not merely pinnatifid or pinnate, as in the type, but bipinnate, the pinnules being completely separated and connected to the rachis by a small appendage and themselves pinnatifid. These fronds in general closely approach the shape of *A. Bradleyi* and might be confused with that fern by the amateur, if it were not for the color of the stipe.

The fact that *obliquum* and *dissectum* are closely associated in growth where both are found might lead us to think that surely *dissectum* was only a variety. But their close proximity in growing would not necessarily prove that. Could it not be explained on the ground that both require the same environment? In seeking for *obliquum* in the South I always hunted for the right environment before I looked for the fern.

That is, a blackberry patch in the shade of trees, or an old rail fence where the soil had been washed in, or any shady place where decayed leaves and loose soil had accumulated. There I expected to find the fern. It was usually the case with *Asplenium pinnatifidum* and *A. Bradleyi* that wherever I found the first I usually found the second. The apparent reason for this is that both seem to require the same environment. As was demonstrated in the soil reaction experiments carried on by Dr. E. T. Wherry, *pinnatifidum* is identical in soil requirements with *Bradleyi*. Perhaps if soil experiments should be made for the two Botrychiums, the same conclusions would be reached concerning them.

Now the question arising in my mind is this. If *B. dissectum* is not a valid species, but only a mutant, why should it not be found in the southern states with the type, of which we have plenty there as well as in the northern states? While these considerations do not prove the validity of the species, yet to my mind they go far to refute the theory advanced by Prof. Chamberlain and others as to *B. dissectum* being only a mutant.

Stockport, Iowa.

A Monograph of the Isoetaceae[1]

T. Chalkley Palmer

Students of the Pteridophytes will welcome this work. The thing greatly needed doing. Since the appearance of the monograph of Motelay and Vendryès in 1883, there has been nothing of the same order, and Engelmann's admirable publication of 1882 was the latest to collate the data on the species of North America. Meantime a deal of collecting and comparing has been done,

[1] Annals of the Missouri Botanical Garden, Vol. IX, No. 2. By Dr. Norma Pfeiffer. April, 1922.

especially perhaps in America, and it was time for some competent botanist to bring together the scattered results. Let it be said at once that an examination of Dr. Pfeiffer's work leaves an impression of great industry guided in general by good judgment. On the whole, one is glad to go along with this admirably clear and generally convincing account. The systematology of *Isoetes* is no subject to be taken up and dealt with casually or while standing on one foot. The author has taken great pains not only to examine a wide range of herbarium material, but also to indicate with great particularity the local habitation of the same, the collectors, the stations, when and where collected, and the main environmental features when known. All this is as it should be, and much more necessary than in the case of some other groups of plants. Justification can be found even for the most phenomenal list of specimens—that under *I. Braunii*, which runs to 16 closely printed pages, and for other lists including specimens of the same form, taken by the same collector from the same station at very short intervals of time. These citations have a very definite value in the present state of our knowledge of this rather intricate group. But in view of the sedulous character of this research, one may perhaps be permitted to ask why the herbarium of the Academy of Natural Sciences of Philadelphia was not among those examined. It is not altogether lacking in significant material. In spite of all exertions, "adequate material" representative of 17 foreign species was not obtained. The total number of species described is 64.

The plan of the work includes headings on History, Local Names and Economic Uses, General Morphology, Ecological Relations, Material Examined, Relationships in the Genus, and the systematic part with its keys, followed by excellent indices and ending with 19 plates, reproducing photographs of 49 groups of mega-

spores. There is a useful bibliography of the morphology of the group, and the text of all this portion seems quite adequate to its purpose. The author's main contribution, and the most interesting part of the work, is the systematic part. Dr. Pfeiffer has abandoned the classical headings *Aquaticae* (with subheads *Submersae*, *Palustres* and *Amphibiae*) and *Terrestres*, and concentrates first of all on the megaspores. This leads to a grouping under the four heads *Tuberculatae*, *Echinatae*, *Cristatae*, and *Reticulatae*, in accordance with sculpturing of the exospores. "It seemed that the spore characters, related as they are to fruiting rather than to vegetative stages, might prove more consistent." Under each of these heads there is a further sorting on the strength of less constant characters. In general this course seems to have had happy results. The classification will probably work admirably for practical purposes. But Dr. Pfeiffer would scarcely claim it to be the last word and the final scheme. If and when the genealogical relationships of the species of the world become understood (the time certainly has not come for that) the probabilities are that we shall then find, e. g., the *I. lacustris* allies such as *I. macrospora* and *I. occidentalis* in closer alignment.

Space is lacking for proper consideration of the author's grouping of known forms into species, varieties, etc. In general there is a commendable tendency to reduce varieties to mere ecological forms and seasonal states. The consolidation of two or more "species" into one has been carried to a point that the late Mr. A. A. Eaton might have considered extreme. This very able and enthusiastic student and collector changed his mind more than once about the relationships of some of his own forms, and, had he lived longer, he might have had reason, as material accumulated, to make still further modifications. But it is to be remembered that his

judgment, whenever it became settled, had a certain peculiar weight because of his extensive studies in the field. In *Isoetes* above all are such studies necessary. So now, when in 1908 he strictly limited *I. riparia* to the Delaware River (Gray's Manual) and relegated the plentiful New England material to other species, he probably had reason. And surely it is stretching things a bit too far when *I. Dodgei* is made a variety of *I. riparia*. Make it *I. canadensis* if so it must be, but certainly not *I. riparia*. This is to minimize too greatly the significance of the peripheral strands, to say nothing of ignoring the "indescribable" differences evident in the field, let them vanish as they will in the herbarium.

It would be pleasant to be able to end with a word of praise for the illustrations. A certain evil spirit seems to dog the footsteps of all who go about to picture the spores of *Isoetes*. The difficulties inherent in the process of photographing spherical bodies by reflected light are well recognized. Recourse, therefore, is usually taken to drawings, often with poor results. But that these plates represent the best that can be done in the photographic way is a proposition to be denied with a high degree of ferocity. The failure to exclude imperfect and non-typical megaspores, the use of lenses of too great aperture and therefore of too shallow focal plane, and a too exclusively one-sided illumination, have combined to produce lamentable effects. More difficult objects have been much better rendered. These photographs are not helpful and their inclusion in this otherwise admirable work is to be regretted.

MEDIA, PA.

Other Recent Fern Literature

Those who are collecting the ferns of distant lands or endeavoring to widen their knowledge of the manifold tropical forms will be glad to have the neat little volume

that has recently appeared on the ferns of the Bombay Presidency, in British India, from the hands of Dr. E. Blatter and Prof. J. F. d'Almeida, of St. Xavier's College, Bombay.[1] There is a helpful introduction on the structure, venation and life-history of ferns, with an account of their distribution and some suggestions on their cultivation. The bulk of the book is given to a fully descriptive and well illustrated list of the species found in Bombay, most of which are said to appear and complete their development in the four rainy months of that region. The keys to genera and species are unusually full and explicit. Fifty-four genera are comprised in the list, and it is of some interest to note that none of these are represented by large numbers of species, as is true of the fern flora of most tropical localities. The largest genera are Adiantum with 14 species, Lastrea with 9, Pteris and Nephrodium with 8, and Asplenium with 7. The tree-ferns are represented by one Alsophila and two species of Cyathea, the filmy ferns by one Hymenophyllum and three species of Trichomanes, and climbing ferns by 3 species of Lygodium and 2 of Davallia. Most of the genera are familiar in the American tropics, and even a number of species, such as *Hymenophyllum polyanthos*, *Adiantum macrophyllum*, *Pteris longifolia*, *Blechnum occidentale*, *Nephrodium unitum*, and *Acrostichum aureum*.—FORREST SHREVE.

APOGAMY IN PHEGOPTERIS POLYPODIOIDES. Brown, Elizabeth D. W., Bull. Torrey Club **50**: 17–34. f. 1–20. 1923.

Fern reproduction, in its two alternating stages of spore plant and prothallium, that is, of non-sexual and sexual generations, is always interesting, even in its

---

[1] Blatter, E. and d'Almeida, J. F. The Ferns of Bombay. 221 pp., 15 pl., 43 fig. Bombay, D. B. Taraporevala Sons & Co., 1922.

normal course. However, it frequently deviates from normalcy. Sometimes the ordinary fern plant produces a prothallium from a leaf tip without the intervention of the usual spore stage (apospory, i.e., "without spore"). Apparently any leaf cell can function as a spore. The other variation is the omission of the true sex cells in the prothallial stage (apogamy, i.e., "without marriage"). The new spore plant, the ordinary fern specimen, begins its growth directly from a vegetative cell of the prothallium. The apogamy in the beech fern here considered is described as consequent upon unfavorable nutrient conditions. The basic explanation of both apogamy and apospory is one of the unsolved mysteries of botany.—R. C. B.

RUDIMENTARY SPORANGIA ON THE ROYAL FERN. G. T. Hastings, Torreya **23:** 10, 1923.

Mr. Hastings finds in a certain colony of royal fern a "general tendency for all the fronds to be fertile" based on an examination in May, 1922, of over a hundred plants. "These sporangia were about one-third the size of the ordinary fertile ones. All stages were noted, from thickened, tooth-like projections at the ends of veinlets to perfectly formed small sporangia. Many of the smaller clumps of the fern, apparently young ones, had no fertile leaves, but some of these had a few leaves with rudimentary sporangia." . . . "Later in the season plants were examined from time to time without finding sporangia on any of the fronds." Has any reader noted anything like this?—R. C. B.

LARGE FRONDS OF CYSTOPTERIS BULBIFERA.—I notice in a recent number of the FERN JOURNAL Miss Marshall tells of finding a frond of *Cystopteris bulbifera* three feet long. I can beat that. for near St. Ignace, Michigan,

I found several fronds of that species each of which measured over five feet in length. The ferns were growing in a cedar swamp and were so long they had the appearance of vines. They were not on rocks, nor were any rocks to be seen anywhere near them in the swamp, but that whole region is underlaid by limestone and the loose glacial deposits that form much of its surface are very strongly calcareous. I measured several of the fronds and found six of those I measured were over five feet long. The note I made of the individual measurements shows the following lengths: "5 ft. 6 in.; 5 ft. 4 in.; 5 ft. 3½ in. (two specimens); 5 ft. 1 in. (two specimens); 4 ft. 10½ in.; 4 ft. 8 in.; 4 ft. 4 in.; 4 ft. 1 in.; besides several others about 4 ft. in length." They were exceedingly fragile and were more or less twined about the undergrowth and the trunks of the cedars for support. Because of their fragile character it was difficult to collect specimens in good condition and I did not try to make herbarium specimens of any of the longest ones. I tried to get a photograph of the ferns as they were growing, but without very much success, as the density of vegetation in those swamps makes it very difficult to get good pictures.

St. Ignace is a very interesting place, botanically as well as geologically, and we found some very nice ferns about there; but for fern collecting I have never yet found any place that surpasses my favorite hunting grounds in Hocking County, Ohio. On one hillside there I once found twenty species in one afternoon.—Clara G. Mark.

A Fern Pest.—Dealers in fern "greens" report that the 1922 crop was considerably damaged by an insect, described as a "small green worm." The insect in question has long been known to persons in the fern trade, but is said never to have done much harm until

two years ago. "Now large areas are to be found where almost all of the plants have been partly eaten, the insects feeding first at the tender tips." Though troublesome at present, there is reason to hope that the pest will again subside into harmlessness in the course of a few years; and in any case, there are plenty of ferns in uninfested districts to suppply the demand. Prices, however, are likely to run higher. Already there has been an advance of two cents a bunch in the price paid to pickers.

"Nearly a hundred thousand dollars in wages are being distributed in four mountain towns in southern Vermont among the fern gatherers. The extent of the business is not usually realized, even in the trade, but in one year a single firm has shipped twenty-eight million ferns out of Bennington, Vt." (*Horticulture*, Oct. 10, 1922.)

MORE FERN MATERIAL USED BY FLORISTS.—Some time ago my attention was attracted by a window decoration in a New York City shop, which proved to be made of the preserved leaves of the California chain fern. I have recently run across some additional fern material used similarly. There seems to be quite an industry in California for the collection and preservation of fern and other types of leaves in this connection. Leaves of *Polystichum munitum* were recently seen. The method of preservation as reported to me consists in treating the leaves with glycerine in addition to a green paint or dye. The result in color when fresh is a metallic green. In the course of weeks, especially under bright illumination, the green fades out and becomes greyish.

In Syracuse recently I saw in a florist shop the pod-like fruiting leaves of the sensitive forn used for decoration. Apparently they had been merely dipped in paints of various colors, some gilded, some silvered, and some in other colors. Their rigidity made them de-

sirable in the center of decorations which included gilded Panicum grass. In the same shop there were the empty, dried, open pods of milkweed painted in different colors, prepared for Christmas decoration. New York shops are showing teazle heads prepared in the same way. I am told that the preparation of the material has become a fair-sized industry for the Christmas trade.—R. C. BENEDICT.

By way of answer to Dr. Benedict's query whether anyone has observed the polypody growing as an epiphyte in eastern America, the following instances, taken from Prof. Fernald's article on *Polypodium virginianum* and *P. vulgare*, may be cited. In 1878, Lester F. Ward discovered it near Washington growing on trunks of red birch several feet above the base. "The roots have taken a firm hold in the clean, living bark, so that I collected my specimens with a knife, leaving the bark attached." Macoun and Burgess, in 1884, reported it as growing plentifully on old elm trees at three localities in Ontario. In 1906, Prof. J. Franklin Collins found and photographed several trees of black birch with festoons of polypody hanging from the lower halves of the trunks. Similar instances were observed in Nova Scotia by Prof. Fernald himself in 1920: here the creeping rootstocks ascended in the crevices of the bark to the height of 2 or 3 meters.

A MYSTERIOUS REPRINT OF NO. 1 OF THE FERN BULLETIN.—The little early numbers of the *Fern Bulletin* are not easy to obtain. Therefore, when, some months ago, I saw a copy of no. 1 advertised for sale in a book-dealer's catalogue, I ordered it at once; and was much surprised, when it arrived, to find that it was not a genuine no. 1 at all, but a reprint. I had no idea that such a thing existed and the several persons, likely to know

about it, to whom I applied for information, proved to be no better informed. The dealer from whom I bought it replied to my question that he got his books from many sources and could not tell where this one came from.

The reprinting has been carefully done; line for line, the matter is the same as in the original. For anyone who wishes it for reference only, the reprint is equally valuable. Unfortunately, whoever made it neglected to put on it any indication whatever that it is a reprint; it might conceivably be palmed off as an original on some one not familiar with the real no. 1. For these reasons, it seems worth while both to record its existence and to give the following comparative description by which it may be recognized.

LINNAEAN FERN BULLETIN, NO. 1, 1893

	Original	*Reprint*
Size of page	$3\frac{1}{4} \times 5\frac{7}{16}$ in.	$4\frac{3}{4} \times 6\frac{1}{4}$ in.
Size of block of type	$2\frac{1}{2} \times 4\frac{3}{8}$ "	$2\frac{7}{8} \times 4\frac{1}{4}$ "
Cover	yellow paper	none
Title-page	second line, "Linnaean Fern Bulletin," curved: no page-numbers on back of title-page or at bottom of first page of text	second line straight: page-numbers in places noted
Paper	of ordinary quality, not water-marked	of fine quality, water-marked "Strathmore Japan."

The type is also a little larger in the reprint.—C. A. WEATHERBY.

American Fern Society

Brooklyn Botanic Garden Meeting for the Conservation of Native American Plants on May 23, 1923

The announced meeting of four organizations, New York Bird and Tree Club, Torrey Botanical Club, the Wild Flower Preservation Society, and the American Fern Society, was held at the Brooklyn Botanic Garden. In the morning the schedule called for a bird trip with Dr. G. M. Reed, a tree trip with Dr. A. H. Graves, and inspection of grounds led by Mr. Norman Taylor. After luncheon at noon, a meeting was held in the Laboratory building for the purpose of considering the topic of "Game Laws for Wild Plants." Under this program there were shown machines for the continuous and automatic projection of slides which is especially adaptable for use in spreading news about wild plants in need of protection.

Following this there was presented a paper under the title "Game Laws for the Conservation of Wild Plants" by Dr. R. C. Benedict of the Fern Society. The talk included a summary of some of the laws already existent in other states with some discussion of their particular features. A number of letters were read representing the general support which the movement is receiving, including the important fact that florist organizations and trade publications are entirely in sympathy with the general idea. The lecture was illustrated with a series of slides presenting types of plants that needed protection in various states, together with others which may be safely picked.

Following the lecture the organizations represented met severally to choose representatives to serve on a committee for the preparation of a conservation statute for New York State. The meeting at large voted un-

animously to recommend such a law. The committee was selected as follows: For the Fern Society, Dr. R. C. Benedict, Chairman; For the N. Y. Bird and Tree Club, Dr. Clyde G. Fisher; for the Torrey Botanical Club, Dr. M. A. Howe; for the Wild Flower Preservation Society of America, Dr. Homer D. House; attorney, Mr. Augustus O. Bourn (member of several societies).

Report of the Curator for 1922

Since the last published report of the Curator the Society Herbarium has received the following additions:

Mr. C. E. Waters	about 1200 sheets.
Miss Elmira Noyes	160 sheets.
Rev. Fred Gray	52 sheets.
Mr. E. W. Graves	75 sheets.
Mr. D. LeRoy Topping	117 sheets.
Mrs. L. R. Cornman	35 sheets.
Mr. Geo. L. Moxley	1 sheet.
Mr. J. C. Nelson	5 sheets.
Total	1645 sheets.

Pressure of other work has prevented the mounting and cataloguing of this material but with better facilities for doing this kind of work now at hand the additions named above will soon be incorporated into the Society Herbarium.

Prof. John Schaffner of Ohio State University has made a careful examination of the specimens of the Genus Equisetum in the Society Herbarium, making some much needed corrections in identification.

Members are taking advantage of the privilege of borrowing specimens from the Herbarium to a greater extent than ever before as evidenced by the number of requests for the loan of specimens.

The Society urgently needs a complete set of all the forms and varieties of *Polypodium vulgare* and those

who have duplicates to spare are requested to send them in, along with specimens of any other species they may have.—L. S. HOPKINS, *Curator.*

Henry Clinton Bigelow, a member of the Society since 1908 and for a short time its treasurer, died at New Britain, Conn., Nov. 15, 1922. He was born at New Fairfield, Conn., where his family had lived for several generations, Sept. 18, 1865. At nineteen, while in the West, he had a severe illness, improper treatment of which left him a helpless invalid for a time and permanently lame. In 1886 he came to New Britain and there spent the rest of his life, doing patiently, cheerfully, and well, such work as his health permitted, and, at least in his later years, spending all his spare time and energy in the study (we might say in the company, as expressing his feeling toward them) of the local plants, particularly ferns and orchids. In spite of his physical handicap, he covered the region about New Britain, much of it rugged, very thoroughly, and had gathered such a minute and comprehensive knowledge of the ferns of his territory, and of their haunts and habits, as few of us acquire. This knowledge, and his specimens, he shared freely with numerous correspondents. Unfortunately, his modesty prevented him, even when urged, from setting down much of what he had learned for publication; only a few of his observations have had printed record.

One incident may be related as showing the keenness of his observation. Two of us once took him to see a station for the hybrid *Dryopteris Goldiana* × *marginalis* which we had discovered. We found the place much changed and trampled by cattle; after a long search the two of us who had been there before failed to find the hybrid and went on to hunt for it elsewhere, leaving

Mr. Bigelow to rest. When we came back, in about an hour, he had it, having recognized a plant among underbrush from a fragment of a broken frond, all that the cattle had left.

He was a faithful and energetic member of the Society. He never missed an opportunity to secure a new member, and for a long time was accustomed to lighten the labors of the treasurer by personally collecting the dues of the local members. Some of us, at least, will remember the sets of *Dryopteris* hybrids which he distributed to members of the Society, but only a few know the amount of time and labor which he put into their preparation, and the pains he took to insure accurate determination of all the specimens.

Photographs of Mr. Bigelow have twice appeared in the JOURNAL. In Vol. 3, p. 22, 1913, he is shown as one of a group of members attending the Hartford meeting of the Society and in the frontispiece of no. 3 of Vol. 5, 1915, exhibiting to Mr. Ware a station for Scott's spleenwort, one of his choicest finds.

Mrs. Lucy Leonora Hutchinson Goodrich, long known in central New York, particularly as a competent student of native plants, died on April 5, at the age of nearly 92 years. Members of the Fern Society who attended the Field Meeting held at Syracuse several years ago will remember Mrs. Goodrich as one of those who made the trip to West Green Lake where most of the members had their first opportunity of seeing the hart's tongue fern.

Mrs. Goodrich was born in Onondaga County and spent all her life there. For many years she was a teacher in public schools, and for sixteen years before her retirement was principal of one of them. For 30 years she was President of the Syracuse Botanical Club and was the author of "A Flora of Onondaga County."

New members:—

Chisholm, Miss Maude L., Proctor, Vt.
Lownes, Albert W., 69 Manning St., Providence, R. I.
Mackenzie, Kenneth K., 27 William St., New York City.
Monroe, Will S., 33 Portland Place, Montclair, N. J.
Spalding, Mrs. William, 405 Comstock Ave., Syracuse, N. Y.
Vaughn, Mrs. A. S., 8 Vernon St., Rutland, Vt.

Changes of address:—

Angell, Miss Anne S., Brattleboro, Vt.
Beckwith, Miss Florence, 31 Arlington St., Rochester, N. Y.
Brown, Miss E. G., 260 Genesee St., Utica, N. Y.
Cheever, Dr. A. W., 16 Elmore St., Newton Centre, Mass.
Wheeler, Dr. E. J., 25 South Hawk St., Albany, N. Y.

A group of fourteen colleges, scientific institutions, and scientific societies, headed by the Academy of Natural Sciences of Philadelphia, have united to hold meetings commemorative of the hundredth anniversary of the birth of the distinguished naturalist, Joseph Leidy, at the Academy on the afternoon and evening of Thursday, December 6th, 1923. The Fern Society has been invited to send representatives to these meetings.

Mr. H. G. Rugg, Dartmouth College, Hanover, N. H., offers specimens of *Lycopodium Selago* from Mt. Katahdin to members for postage.

Mr. C. H. Bissell (Chairman), Miss Annie Lorenz, and Mr. E. H. Clarkson have been appointed a committee to nominate officers for 1924. Rev. John H. Davis has been appointed Judge of Elections.

Wanted—*Camptosorus sibiricus* Hook. Will buy or give in exchange any of the following: *Botrychium Lunaria*, *Cystopteris montana*, *Odontosoria Wrightii*, *Dryopteris Cumingiana*.—E. W. Graves, Stockport, Ia.

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Vol. 13 October-December, 1923 No. 4

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A QUARTERLY DEVOTED TO FERNS

Published by the

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EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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L. S HOPKINS - - - Culver-Stockton College, Canton, Mo.

A regular loan department is maintained in connection with the Society herbarium. Members may borrow specimens from it at any time, the borrower paying all postal or express charges. The pages of the Journal are also open to members who wish to arrange exchanges; a membership list is published to further assist those interested in obtaining specimens from different ocalities.

American Fern Journal

Vol. 13 OCTOBER-DECEMBER, 1923 No. 4

Ferns of Eastern West Virginia. I.

Edgar T. Wherry

The eastern part of the state of West Virginia is occupied by mountain ridges with a general northeast-southwest trend, attaining a maximum elevation of 1450 meters (4800 feet) at Spruce Knob, in Pendleton County, and only slightly less on Cheat Mountain in Randolph and Pocahontas Counties. The ridges are capped for the most part by sandstone and conglomerate rocks, while the valleys between them are underlain by shale or limestone, the relief being a direct expression of the relative resistance of these rock groups to erosion. Most of the cliffs are, correspondingly, siliceous in nature, and the soils in their crevices tend to be acid, because when bacterial action turns the material of in-falling plant fragments into acid compounds, no neutralization by rock minerals can take place. The softer rocks also yield cliffs at times, where streams have cut through them, but here the soils are in general circum-neutral, because any acids which tend to develop are promptly neutralized by the calcium carbonate present in the rocks. The distribution of many species of ferns in the region is largely controlled by these soil relations.

A good illustration of this can be seen on the flanks of Shavers and Cheat Mountains, Randolph-Pocahontas Counties. High on these ridges, where the rocks are sandstone and conglomerate (Pennsylvanian) the soils

[Vol. 13, No. 3 of the Journal, pages 67–103, plate 3, was issued Oct. 3, 1923.]

are mostly acid, and the spinulose shield ferns, especially *Dryopteris spinulosa dilatata* [*americana*] are widespread. On descending over either slope and approaching the stratum of Greenbrier limestone (Mississippian) which outcrops along the flanks of these ridges, the soil becomes less acid and the fern flora changes. *Dryopteris marginalis* and *Athyrium acrostichoides* are the first to appear, and when the neutral limestone soil is finally reached, *Dryopteris goldiana*, *Athyrium angustifolium*, *Cystopteris bulbifera*, etc., dominate. Further down the hills the limestone gives way to shale, and the three last mentioned species disappear again.

It is proposed to limit the data in this and the following article to eastern West Virginia, partly because ferns have not been extensively collected here before, while it is the only portion that the writers have studied in this respect, and partly because the central and western portions belong to the Appalachian Plateau province and show rather different rock and soil conditions. The counties mentioned in these articles have geographic positions suggested by the adjoining tabulation:

Morgan
Mineral Hampshire Berkeley
Tucker Grant Hardy Jefferson
Randolph Pendleton
Webster Pocahontas
Greenbrier
Summers Monroe

In Millspaugh's "Living Flora of West Virginia," published by the State in 1913, fifty species and varieties of ferns (including *Ophioglossaceae* and *Osmundaceae*) were recorded. Three are known to have been added since that time: *Pteretis nodulosa* (*Struthiopteris*),[1] *Athyrium asplenioides* var. *subtripinnatum*,[2] and *Woodsia*

[1] *Am. Fern J.*, **9:** 2. 1919.
[2] *Rhodora*, **19:** 180. 1917.

scopulina.[3] In the present article the following are announced for the first time: *Asplenium ebenoides* R. R. Scott, *Asplenium gravesii* (*A. pinnatifidum* × *bradleyi*) Maxon?, *Asplenium resiliens* Kunze (*A. parvulum* M. & G.), and *Woodsia ilvensis* (L.) R. Brown.

In the article following this one, Rev. Fred W. Gray announces a considerable number of others as new to the state.

ASPLENIUM EBENOIDES R. R. Scott.—This fern was first recognized in the state by Messrs. Dinkle and Stotler of Harpers Ferry, Jefferson County, growing in soil which proves to be slightly acid on shale ledges along the Shenandoah River a few miles west of the town. The single original plant shows the typical irregularly pinnatifid fronds, becoming entire above, and inheriting from its walking parent the tendency to root at the tip. In 1921 another plant appeared on the same ledge, about 25 cm. away from the first. Another station was discovered in 1919 by the present writer in neutral soil on limestone ledges along a small tributary of the Potomac northwest of the town, a single plant being found here also; but as in some seasons nearly all the mature fronds show at their tips minute buds with tiny fronds starting up from them, this colony seems also to be likely to increase. The rock ledge on which the colony occurs is remarkable in the number of species it supports, *Pellaea atropurpurea*, *Asplenium platyneuron*, *A. trichomanes*, *Camptosorus rhizophyllus*, *Cystopteris fragilis*, and *Woodsia obtusa* being all there within a radius of less than a meter; while *Cystopteris bulbifera* grows not far down the rocks.

ASPLENIUM GRAVESII Maxon (*A. pinnatifidum* × *bradleyi*)?—This hybrid, originally described from Georgia, and later recognized in Pennsylvania,[4] appears

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[3] *Am. Fern J.*, **9:** 1. 1919.
[4] *Am. Fern. J.*, **10:** 119. 1920.

to be represented by a specimen found by members of the Washington, D. C., Chapter of the Wild Flower Preservation Society of America early in September, 1922, on sandstone ledges along the Shenandoah River a few miles northwest of Harpers Ferry, West Virginia. *Asplenium pinnatifidum*, one of the parents, is abundant over the cliffs at this place, although *A. bradleyi* has not as yet been observed there. The specimen in question is clearly distinct from the former, however, in having brown stipes and rather sharply toothed segments. It is hoped that further search can be made at the locality both to find more typical material and confirm this identification, as well as to locate the second parent species. The latter is now known from the state as a result of the activities of Mr. Gray, but his station is fully 200 miles further southwest.

ASPLENIUM RESILIENS Kunze [= *A. parvulum* M. & G.][5].—This southern species, which is well known to push northward in the limestone valleys in the Appalachians, is abundant along the New River in southwestern Virginia, but does not appear to have been noted in West Virginia heretofore. In the course of a trip with Mr. Gray in 1921, the primary purpose of which was the tracing of the distribution of the box-huckleberry, we inspected limestone ledges to find out if huckleberries were actually growing on them (Pursh having ascribed this species to limestone). As expected, no huckleberries were found there, but on limestone

[5] In selecting scientific names of ferns the writer prefers to use those the validity of which has been most recently pointed out, in so far as these proposals seem likely to gain general acceptance. However, since many of these names are not to be found in any of the well-known books, synonyms which are widely used may well be added in brackets, to enable readers who do not have wide access to periodical literature to know what ferns are being discussed. Names which are clearly erroneous, whether old (e.g., "*Dic sonia*" for the hay-scented fern) or new (e.g., "*Aetopteron*" for the Christmas fern) should, if included at all, be placed in quotations, as the sooner they are forgotten the better.

cliffs along Second Creek near the post office of that name, in Monroe County, this fern was discovered in some abundance. Mr. Gray has also found it since at other localities in the same general region, as will be described in his article. The soil is neutral or nearly so, as seems normal for this species.

WOODSIA ILVENSIS (L.) R. Br.—In 1918, Mr. Harry W. Trudell and the writer took a vacation trip through the mountains of West Virginia, in the course of which we traveled from Franklin, Pendleton County, to Petersburg, Grant County, in the auto of the mail carrier. Engine trouble led to a brief halt about a mile south of the village of Landes, just within the first named county, and here along the road, in soil of minim-acid reaction on shale ledges, we found an abundance of the rusty woodsia.

PTERETIS NODULOSA (Michx.) Nieuwland [= *Onoclea Struthiopteris* of Am. authors, not L.].—During the trip just mentioned we also rode on a lumber train running south from Horton, Pendleton County, toward the highest part of the county, along Spruce Mountain. The track follows Dry Fork, a small tributary of Cheat River, for some miles, and in the meadows adjoining we soon noted the presence of the ostrich fern. Taking advantage of a halt for shifting a car, we jumped off and collected enough to establish the correctness of our identification. This find, which represents the southern-most known occurrence of this species, was duly reported by Mr. Maxon in this JOURNAL.[6]

The so-called DRYOPTERIS FRAGRANS Schott [*Thelypteris fragrans* var. *Hookeriana* Fernald].—On Spruce Knob, Pendleton County, the highest point in the state, the presence of *Dryopteris fragrans* was reported in the West Virginia flora. That the report was probably erroneous was later noted in the *American Botanist*,

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[6] *Am. Fern. J.* **9**: 1. 1919.

but does not appear to be referred to in the AMERICAN FERN JOURNAL. On visiting the locality in the course of the above mentioned trip, Mr. Trudell and the writer found that the *Dryopteris* there is *D. spinulosa*, differing from the typical form of this species in being very diminutive in size, so that in the manual keys it would come out to *D. fragrans*. The dwarfing is clearly connected with the fact that the forest which once covered this mountain has been completely cut away, and what was once a cool, moist, shaded spot where shield ferns abounded has become a barren, rocky slope where only the hay-scented fern and brake would be expected to find a foothold. However, the *Dryopteris* which once flourished in the woods has somehow managed to persist, and grows in rather considerable abundance, even producing some spores, in this dry, sunny place; although its starved aspect indicates that it will probably ultimately succumb to the strain unless by some fortunate chance the mountain should be reforested.

WASHINGTON, D. C.

Supplementary List of the Ferns of the Lake George Flora, New York

STEWART H. BURNHAM

The preliminary list was published in the American Fern Journal **6**: 85–90, July–Sept. and 97–105, Oct.–Dec., 1916; **7**: 12–15, Jan.–March and 54–63, April–June and 124, Oct.–Dec., 1917. Most of the additional data were collected during the year 1918. Mrs. Orra Parker Phelps of Wilton, Saratoga County, has furnished new stations for our rarer ferns. A few *Botrychiums* and *Lycopodiums*, collected by Dr. Karl M. Wiegand and others, are preserved in the herbarium of the N. Y. State College of Agriculture, Cornell University, Ithaca,

N. Y. The nomenclature follows that of the preliminary list.

OPHIOGLOSSACEAE

OPHIOGLOSSUM VULGATUM L. Greenfield and Wilton (*Mrs. Phelps*); dry woods, Copeland Pond brook; Copeland Pond marsh; southwest corner of Hadlock Pond, where the water has receded.

BOTRYCHIUM SIMPLEX E. Hitchc. Galway (*Phelps*); Big Notch, north of Peaked Mt., W. Fort Ann; dry pastures about one-third mile west of Vaughns schoolhouse; Crawford's woods, east of Tripoli schoolhouse; pasture one-third mile west of Tripoli schoolhouse, several plants.

BOTRYCHIUM NEGLECTUM Wood. Wilton, "along a maple shaded woodroad (once a highway), I find every season literally hundreds of plants. Many are very large and 2–3 fruiting fronds are not uncommon" (*Phelps*). Road by Wiggins ore mine; Peaked Mt. ravine at the southern base; abundant under white pines, northwest of Farley's, east of Tripoli, southern W. Fort Ann.

BOTRYCHIUM LANCEOLATUM (S. G. Gmel.) Ångst. Wilton (*Phelps*); Big Notch, north of Peaked Mt.; under evergreen trees, Woodside cottage, Warner bay, East Lake George.

BOTRYCHIUM OBLIQUUM Muhl. Sand plain west of Saratoga, along road in open field, Oct. 12, 1916 (*F. P. Metcalf & K. M. Wiegand*, No. 5407).

BOTRYCHIUM DISSECTUM Spreng. No. 5408, collected by Metcalf and Wiegand, with *B. obliquum*. No. 5409, also collected at the same station is transitional between *B. obliquum* and *B. dissectum*.

BOTRYCHIUM SILAIFOLIUM Presl. The large form, known as *B. obliquum Habereri* Gilbert, in mixed woods,

eastern base of Sugar Loaf Mt., southwestern W. Fort Ann.

OSMUNDACEAE

OSMUNDA REGALIS L., forma INTERRUPTA Milde. The aberrant pinnules incised toward the base, fertile on the margin only, or sometimes throughout; abnormal pinnae borne just above the middle of the sterile frond. Swamp woods, west of Stone schoolhouse, 1 mile north of Tripoli, southern W. Fort Ann, August 15, 1918.

POLYPODIACEAE

ONOCLEA SENSIBILIS L., forma OBTUSILOBATA (Schkr.) Clute. Mrs. Phelps says, "usually found after the first crop of fronds have been cut."

PTERETIS NODULOSA (Mx.) Nieuwl. Greenfield (*Phelps*); mountain woods, along brooks, 1200°, Hogtown hill, north W. Fort Ann.

WOODSIA ILVENSIS (L.) R. Br. Greenfield (*Phelps*); Silver Bay, Lake George (*Phelps*); northwest Hartford, rare; Fort Ann to Flat Rock.

WOODSIA OBTUSA (Spreng.) Torr. Greenfield and Silver Bay (*Phelps*).

FILIX BULBIFERA (L.) Underw. Greenfield on a small outcrop of lime, not far south of the old St. Clements College; also in the mountains of Wilton, on outcrops of lime which are not indicated on the geologic map of the region (*Phelps*). East of Thompson's gravelbed, southern W. Fort Ann, in calcareous springy places; Jay Vaughan's copse near Devines woods, Vaughns.

POLYSTICHUM ACROSTICHOIDES (Mx.) Schott. Ravine at southern base of Peaked Mt., the var. *incisum* Gray; also plants with forked fronds.

DRYOPTERIS GOLDIANA (Hook.) Gray. Foot of talus-covered slope, Wilton, very rare (*Phelps*); rocky woods, east of Tripoli schoolhouse, rare.

DRYOPTERIS BOOTTII (Tuck.) Underw. Mrs. Phelps says; "I have found this fern in a number of swamps."

DRYOPTERIS PHEGOPTERIS (L.) C. Chr. Wilton and Greenfield, frequent (*Phelps*); Hogtown hill; Crosset Pond.

DRYOPTERIS HEXAGONOPTERA (Mx.) C. Chr. Wilton and Grenfield, frequent (*Phelps*); Hogtown hill.

ANCHISTEA VIRGINICA (L.) Presl. Abundant about Lake Ann, Mt. McGregor (*Phelps*); very abundant in the large sphagnum marsh and Mud Pond marsh, south of Glen Lake, Sept. 11, 1917. It also occurs in the large marsh, west of Glen Lake, Aug. 26, 1906; but does not occur in the sphagnum marsh near the road, on the north shore of Glen Lake, Oct. 31, 1916. Why does not the Chain Fern grow in the marsh north of Glen Lake, as well as the marshes south and west of the lake? These marshes have a similar flora: and are surrounded by gravelly-sandy wooded hills.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link. Greenfield and limestone outcrop near Kings Station, Wilton (*Phelps*).

ASPLENIUM EBENOIDES R. R. Scott. Top of a cliff near Paradise Bay, Lake George (*Frank Quinlin*); reported to occur, but was not verified by Mr. Quinlin, July 26, 1922. At Silver Bay, across the lake; both *Camptosorus* and *Asplenium platyneuron* are found. Two plants were found about one-eighth of a mile south of Kings Station, 1919, on a small lime outcrop (*Miss Bessie Phelps*). Mrs. Phelps says, Nov. 30, 1920: "I have a magnificent plant of *Asplenium ebenoides* growing in the house." Four plants have been found at this station.

PTERIDIUM AQUILINUM (L.) Kuhn. Crosset Pond. Several plants, margin of sandy hilly woods, one half mile northwest of Tripoli, July 25, 1920. Mr. Charles A. Weatherby says, Aug. 3, 1920; "Your form, (unless

you can discover something pathological about it, and I do not see any signs of that) seems to me a mutation tending toward a dimorphic condition. The fertile pinnules are pinnatifid whereas the sterile of the same order are entire. There is a plant like it in the Gray Herbarium, collected in dry woods at Houlton, Aroostook county, Maine, by M. L. Fernald, Aug. 26, 1891." Similar plants have also been collected in New Jersey by Rev. C. S. Lewis.

EQUISETACEAE

EQUISETUM SCIRPOIDES Mx. Wilton, common (*Phelps*).

LYCOPODIACEAE

LYCOPODIUM INUNDATUM L. East Pond, Stony Creek Ponds, June 29, 1899 (*W. W. Rowlee, K. M. Wiegand & G. T. Hastings*); Wilton, near Loughbury Lake, very rare (*Phelps*); mossy log in water, east shore of the middle pond, Three Ponds, W. Fort Ann, Aug. 30, 1918.

LYCOPODIUM OBSCURUM L. Mrs. Phelps says, May 17, 1920: "I have found as many as twenty prothallia," which have not often been collected in the United States.

LYCOPODIUM ANNOTINUM L. Wilton, infrequent (*Phelps*).

LYCOPODIUM CLAVATUM L. The var. *megastachyon* Fernald & Bissell was collected at Stony Creek Ponds, July 1, 1899 (*W. W. Rowlee, K. M. Wiegand & G. T. Hastings*); also road east of Hogtown hill, Sept. 26, 1899.

LYCOPODIUM TRISTACHYUM Pursh. Wilton, infrequent (*Phelps*).

CORNELL UNIVERSITY, ITHACA, N. Y.

An Interesting Relic and its Owner

C. A. Weatherby

There is preserved in the National Museum at Washington a little field note-book of ferns, once the property of the botanical collector, August Fendler. Fendler was a man of unusual and attractive personality and led a varied life: before describing the book, it may be well to give some account of the man.

Fendler was born at Gumbinen, Prussia, Jan. 10, 1813. His father died when the son was six months old: the step-father who in due time succeeded him, could afford to give the boy only an irregular and imperfect education. After some schooling, he was apprenticed to the town clerk; but he was born with a love of travel and the prospect of a life spent at a desk copying legal documents did not at all appeal to him. He presently secured an appointment as general assistant to a government physician who was studying the cholera situation on the Russian border and got his first experience of the world in the midst of an epidemic of that disease. Later, he learned the tanner's trade; later still, in the effort to improve his condition, he entered a government technical school at Berlin. His health nearly broke down under the severe standards of work enforced there (he states that very few students lasted out the full course); partly by way of restoring it, he tramped about Germany for a year, knapsack on back, as a travelling artisan. Finally, in 1836, he sailed from Bremen for the United States.

He landed at Baltimore and worked for a while in a tannery there, but found the work too hard and soon changed both residence and occupation, going to work in a lamp factory in New York. But travel and the wilderness seem always to have been calling him; by 1838 we find him in St. Louis, then on the frontier, after a round-

about and arduous journey. Presently he went to New Orleans, part of the way on foot; thence to Texas. Returning north, he taught school in Illinois. In 1841–2, feeling a desire for solitude, he lived for a number of months alone on an otherwise uninhabited island in the Mississippi River—a refuge from which he was driven by an unusually high spring flood, saving himself and his belongings with some difficulty.

In 1844, he returned to Germany for a visit, in the course of which he met Prof. Ernst Meyer and learned from him for the first time that there was such a profession as that of botanical collector. In later years he regretted that he had not found it out before. Back in Missouri, he devoted himself with enthusiasm to this new occupation, sending his specimens to Dr. Engelmann to be named. In 1846, through the influence of Dr. Gray, he went as naturalist with the United States troops sent to take possession of New Mexico. From that time until 1849 when his books and such of his collections as were still in his hands were destroyed by fire, he collected in the western United States and, for a few months, in Panama. In 1850 he returned to the lamp business, this time in Memphis. In 1854 another botanical opportunity presented itself; he went, with his brother, to Venezuela, where they bought and lived upon a small farm at Colonia Tovar in the mountains above Caracas. In this region, rich in tropical vegetation and especially in ferns, he made the collections which, with those from New Mexico, have won him an assured place in the first rank of botanical collectors.

In 1864, he returned to Missouri and bought a farm on which he lived for some years. In 1871, he once more went to Europe, this time with the intention of remaining; but the New World had got too strong a hold and in 1873 he was back in the United States, settling at Wilmington, Del.

During the leisure hours of a life much removed from the society of other men and especially, as he tells us, in the solitude of his island in the Mississippi, Fendler had thought out a sort of mathematical theory of the universe, its forces and their action, whereby he believed he had unified and to a considerable extent explained all cosmical phenomena. Much of his four years at Wilmington was devoted to getting published a little book, "The Mechanism of the Universe," in which this theory was set forth—a book which he always confidently believed would some day bring him enduring fame.

At Wilmington, he was subject to severe attacks of rheumatism: feeling that he needed a milder climate, he removed in 1877 to Trinidad, where, again with his brother, he bought and lived on a small farm near Port of Spain. He was always interested in meteorology; here in Trinidad he took readings five times a day from his various instruments. This, with "his industry and exactness, traits of character so unusual among the population of Trinidad, combined with the daily drying of botanical papers, an occupation which, as many botanists know, excites the wonder and amusement of people claiming a much more enlightened civilization,[1] soon rendered the brothers liable to a suspicion that they were engaged in counterfeiting or some other illicit business." Their house was raided by the police, but no evidence was found of anything worse than that mild form of lunacy which occupies itself in making botanical specimens, and no great damage was done except to Fendler's sensitive feelings.

Fendler died in Trinidad in 1883. According to William M. Canby, who knew him in Wilmington, he was a kindly, simple man (as they who live much with

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[1] I have myself created a faint local sensation by hanging out a hundred or so driers on a clothes-line; and have been told by an amiable lady who appears to have shared the sentiments of the Trinidad police, that pressing flowers did not seem to be a suitable occupation for a *man*.

nature are apt to be), scrupulously honest, gentle, dignified and pleasant in manner, very modest and sometimes even painfully diffident. As a collector he ranks high; his observation and his discrimination were keen and his specimens of excellent quality. His collections from the southwestern United States, then entirely new territory, rank with those of Lindheimer and Charles Wright as classic, and, like them, were described by Dr. Gray in a special paper, *Plantae Fendlerianae*. Those from Venezuela, though there some other collectors had preceded him, are scarcely less important for their region; and those from Trinidad are likewise valuable. Many species of ferns were first found by him; a number, such as *Cheilanthes Fendleri* and *Notholaena Fendleri* of the United States, have been named for him.

The note-book, to which, after this long biographical excursion, we may return, furnishes some interesting evidence of Fendler's methods of work. It is home-made, about ten by five inches (a size convenient for the pocket), stitched into a cover of heavy brown wrapping paper. It contains 16 pages cut partly from foolscap paper and partly from extra plates from the "Mechanism of the Universe." On one side of these pages are sewed fragments (enough in each case to show veining and soriation) of 160 species of ferns. These are consecutively numbered, against each is set down its name, and occasionally brief notes are added. These relate to distribution—such as "common" for *Blechnum occidentale*—or to some character not shown by the fragmentary specimens in the book. Thus, no. 80 (a *Cyathea*) is said to have "a greenish-white spot at the base of the rachis underneath" and no. 167 to be "very hard to dry." In addition there is with each plant a series of figures separated by marks of addition, thus: "5 + 11 + 28; 2 + 3 + 9."

Fendler endeavored to get fifty specimens of each species collected, for distribution to botanical institutions and private herbaria. Evidently, when each species was first found, he gave it a number and placed a fragment of it in his book to aid him in securing nore of the same species. The series of figures probably records the number of specimens collected on different occasions to make up the desired fifty. Thus the book served at once as a sort of condensed manual to aid him in making field determinations and avoiding mixtures of material and as a business record of the quantity of his collections. It was no doubt used in his later work in Trinidad; the numbers correspond to those under which the species concerned were eventually distributed and the names are those given by D. C. Eaton in his list of Fendler's Trinidad ferns published in the third and fifth volumes of the *Botanical Gazette*. After Fendler's death it came into the possession of the well-known collector, W. E. Broadway, by whom it was presented to the Museum. A similar book relating to flowering plants is preserved at the Gray Herbarium.

EAST HARTFORD, CONN.

Recent Fern Literature

One could hardly ask in a local flora for a better plan, more diligently carried out, than is to be found in Fr. Victorin's account of the ferns of Quebec. The introduction deals briefly but clearly with the physiography of the region, the geographical and ecological grouping of the species concerned, and possible explanations of the former in geologic history. There follows a systematic enumeration of the 60 species known to occur in Quebec, with keys for their identification, full bibliography, and index.

All, or much, of this, more or less well done, is to be found in many local floras. But Fr. Victorin goes further. He believes that morphologists and systematists have paid too little attention to each other's work; by way of bridging the gap between them, he has made use of morphological and physiological sources where possible. He has also investigated the nomenclatorial history of each species, its folk-lore and medicinal uses. The result is that under the several species there is a body of notes full of interesting matter, set forth in a style which furnishes pleasurable reading.

Since unanimity is the chief desideratum in nomenclature, Fr. Victorin deserves credit for yielding to the will of the majority so far as to follow the International Rules against his personal preference for "absolute priority." He gives in notes, however, the names which he thinks the plants really ought to bear. The difficulty of maintaining a perfectly correct technical balance while thus riding two horses is well illustrated by the minor mishaps which have befallen him. There are, once or twice, mixtures of Latin genders; and the same species is referred in the notes to a genus equivalent to *Asplenium* and in the text to *Athyrium*.

To a few of Fr. Victorin's statements exception may, perhaps, be taken. In New England, at least, Goldie's fern and the narrow-leaved spleenwort are not indifferent as to soil, as he makes them; though not confined to the immediate vicinity of limestone, they are distinctly plants of neutral soils. Nor, in New England, are *Asplenium platyneuron* and *A. Trichomanes* calcicolous. Most regrettable, however, is Fr. Victorin's inclusion, as full-fledged members of his flora of two species, *Pellaea atropurpurea* and *Thelypteris simulata*, which have not actually been found in Quebec, on the ground that they occur near its borders and are sure eventually to be discovered within them. The present reviewer does

not share Fr. Victorin's confidence on this point. In any case, it is hardly scientifically accurate to list and to include in the count of the species of a region two which have never been found there.

But these are minor blemishes on a remarkably good piece of work. It is to be wished that all of the members of the Fern Society (or at least, all those who read French, in which it is written) might acquaint themselves with this excellent flora.[1]—C. A. W.

Ever since Kuhn, in 1879, separated the bracken (*P. aquilina* L.) from the genus *Pteris*, those who accepted his segregation have unanimously applied to that group the old name of Scopoli's, *Pteridium*, which he used for it, and called by the name of *Pteris* the large group of tropical species of which the widely cultivated *P. cretica* is probably the best known member. Recently, however, it has been maintained that the name *Pteris* properly belongs to the bracken and to it alone, and that the other group must take a long forgotten name of Presl's, *Pycnadoria*. In the English *Journal of Botany* Dr. Maxon argues at length, and, to the present reviewer's mind, very sensibly, against such a conclusion. He closes with the remark that, in any case, the name *Pteris* in its traditional sense "would never be displaced in popular usage; nor, in the writer's opinion, should it ever be displaced"—a dictum to which many who have been annoyed by the frequent changes in plant names will no doubt respond with a hearty "amen."[2]

Dr. Maxon is also continuing his studies of tropical ferns. He has published an account of species new to the Cuban flora, collected by Bro. Léon in the botanically

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[1] Fr. Marie-Victorin. Les filicinées du Quebec. Suppl. Révue Trimestr. Canad. tome IX. 98 pp. Montreal. 1923.

[2] Maxon, W. R: The type species of Pteris. Journ. Bot. **61:** 7-10. Jan., 1923.

unexplored region of the Sierra Maestra in the eastern part of the island,[3] and a synopsis of the eight species of the genus *Culcita*, better known as *Balantium*.[4] He has described a new species of *Dryopteris*, *D. mollicella*, from specimens collected in the island of Dominica by Prof. L. H. Bailey;[5] and the seventh installment of his "Studies of tropical American Ferns" has appeared. It contains a detailed and thorough study of the tree ferns of the genus *Alsophila* and the group of *A. armata*, and notes and new species in several other genera. A new genus, *Atalopteris*, is proposed to contain the species known as *Polybotrya aspidioides*.[6]

Dr. Benedict goes on with his work on the horticultural varieties of the Boston fern. On the practical side of his subject, he has been publishing in the *Florists' Exchange*, beginning with the number for Oct. 29, 1922, a series of articles on "what we know about Boston ferns." These have dealt particularly with the characters by which the different varieties can be identified and with the question which of these varieties is most desirable from the point of view of grower, retailer, and ultimate purchaser. To further assist in settling this question, experimental tests of different forms are under way at the Brooklyn Botanic Garden. Dr. Benedict has described these tests and asked the cooperation in them of commercial growers, experiment stations and agricultural colleges.[7] Appearance, keeping quality under conditions of shop and house, productivity, quickness and continuity of growth, ease of care, and adaptability to special requirements are to be considered in grading varieties.

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[3] Journ. Washington Acad. Sci. **12:** 437–443. Nov. 19, 1922.
[4] Ibid **12:** 454–460. Dec. 4, 1922.
[5] Proc. Biol. Soc. Washington **36:** 49–50. March 28, 1923.
[6] Contr. Nat. Herb. **24:** 33–63, i–viii, pls. 11–20. 1922.
[7] Journ. Heredity **13:** 254–263, figs. 3–9. June, 1923.

On the scientific side, Dr. Benedict has described two new bud sports which have arisen under cultivation. One, an off-shoot from a four-pinnate "lace" variety, has added to the qualities of its parent cresting to such a degree that a fully developed leaf appears "as a dense spherical mass about an inch in diameter." The new variety has further the remarkable faculty of producing new plants directly from its leaf-tissue—the first time such a phenomenon has been recorded in *Nephrolepis*. The small plants thus born may be like that from which they sprang, or may revert to the simply pinnate form of the original Boston fern. A second new variety, a sport from a crested form, shows an apparent intensification of cresting, the first report of such a progression in the genus. Dr. Benedict closes his account of these new forms with a discussion of the general significance of *Nephrolepis* varieties for the study of evolution and for plant classification.[8]

The prothallium of a fern ordinarily gives rise to but one adult, spore-bearing plant; but occasional instances where more than one is produced have been recorded. Dr. Etter has been investigating this phenomenon. He finds that more than one embryo may develop, but not frequently, on prothallia of the ostrich fern, sensitive fern, *Dryopteris mollis* and *Pteris longifolia* in ordinary laboratory cultures. If prothallia are carefully divided into two parts, or even quartered, each portion will function and produce one, or even two, young plants.[9]

In America at least, few persons have seen the tiny prothallia of the club-mosses. Some years ago, A. E. Spessard found and recorded a single prothallium of

[8] Benedict, R. C. New bud-sports in Nephrolepis. Genetics **8:** 75-95, pls. 1-3, figs. 1-2. June, 1923.

[9] Etter, Austin. Polyembryony developed under experimental conditions in certain polypodiaceous ferns. Bull. Torr. Bot. Club **50:** 95-108, pl. 4, figs. 1-7. March, 1922.

Lycopodium lucidulum. By diligent search, he has now gathered over 500 prothallia of this species and 37 of *L. obscurum*. var. *dendroideum*. From this material these organs are for the first time fully described. Those of *L. lucidulum* are almost worm-like bodies varying much in size and shape. Those of *L. obscurum*. var. *dendroideum* vary from the size of a pin-head to 8 × 12 mm. and have a curious dumb-bell-like shape. In the former species, the prothallia ordinarily occur, curiously enough, in much drier ground than the mature plants—too dry, indeed, for their best development. The author suspects that reproduction is usually vegetative and the chief function of spores is to open up new localities for the spread of the species.[10]

The anatomy of the tropical *Equisetum giganteum* has been studied in detail by Isabel M. P. Browne.[11]

Prof. Dupler records an instance in which a sporophyll of *Lycopodium lucidulum* bore two spore-cases, the usual number being, of course, one. Both sporangia were well developed, though one was slightly larger than the other and both smaller than normal. Such a bisporangiate condition is very rare in *Lycopodium*, having been recorded but once before.[12]

Prof. Berry records the finding of sporocarps of the fossil pteridophyte genus *Sagenopteris* in Canada. Such organs have been found only once before. The second discovery strengthens the belief, put forward tentatively on the basis of the first, that *Sagenopteris* is a member of the *Hydropteridineae* (water fern tribe) and related to *Marsilea*.[13]

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[10] Spessard, A. E. Prothallia of Lycopodium in America. Bot. Gaz. **74:** 392–413, pls. 11–18. Dec., 1922.

[11] Browne, I. M. P. Anatomy of Equisetum giganteum. Bot. Gaz. **73:** 447 468, figs. 1 7. June, 1922.

[12] Dupler, A. W. A bisporangiate sporophyll of Lycopodium lucidulum. Bot. Gaz. **74:** 331 332, fig. 1. Nov., 1922.

[13] Berry, E. W. Sagenopteris, a mesozoic representative of the Hydropteridineae. Bot. Gaz. **74:** 329-331. Nov., 1922.

Readers of the JOURNAL have heard of Mr. E. H. Clarkson's fern garden; some of us have had the pleasure of seeing it. Those who have not can now read a fully and beautifully illustrated account of it and of the 34 species it contains, in the *House Beautiful*.[14]

Campbell, D. H. The gametophyte and embryo of *Botrychium simplex*, Hitchcock. Annals of Botany **36**: 441–455. fig. 1–10, plate 16. October, 1922.

Professor Campbell presents here the results of careful study of the prothallium of *Botrychium simplex*, a species not hitherto reported upon in this respect. His material was collected in northern Minnesota by Dr. Lyon. The study shows a similarity between *Botrychium simplex* and *B. Lunaria* in the prothallia as well as in the ordinary fern plant, but these new prothallia are somewhat smaller, two millimeters in length. The first leaf is sterile but with the second leaf there are sporangia and spores. It is probable that prothallia might be found in almost any colony of these plants in which there is a wide range in the size of the specimens and anyone who has the opportunity to collect them would confer service of real value to science by communicating with Professor Campbell who I am sure will be glad to receive additional material of this underground stage of any species of Botrychium or Ophioglossum.

VARIATIONS IN THE DAGGER FERN.—In the course of a trip last summer (1922) my plans called for a railroad journey from Washington to Pittsburgh. On investigating a time-table I was interested to find that the route went through a town marked as 2200 feet above sea level in southwest Pennsylvania. In New York State such an altitude in the Catskills or Adirondacks

[14] Clarkson, E. H. A garden of hardy ferns. House Beautiful **53**: 373–375. 8 plates. April, 1923.

carries with it the beginning of sub-alpine conditions, clear air, and a different vegetation. Arrangements were made to interrupt the railroad journey at the town of Meyersdale, marked as the highest point on the line and a few miles north of the Maryland border. The train arrived about five o'clock in the morning after about twenty miles of running through specially rugged, wild looking country.

Meyersdale proved to be a fairly sizable, hilly town, several streets in extent in each direction. A grocery store furnished fruit and crackers for lunch, and a well travelled road toward the south led in the general direction of what had seemed to be wilder country. Level stretches of road were few. The general topography was more like the central New York hills than like the mountain sections of the same state. Many hills were cleared for pasture or plowed land, but others were wooded over with a second growth of hard woods. The roadside fern flora for the six hours' tramp showed about eighteen types, none uncommon.

A wooded hilltop with a probable altitude of between 2500 and 3000 feet was found to have so many of the common Christmas ferns that a hurried survey and record was made of the material of this species for possible variations. The hilltop was broad and of considerable extent and in part almost impassible because of catbrier and blackberry. Most of the ferns found were on the margin of the hill where the woods were more open. Note was made of about 400 clumps of Polystichum, often comprising several crowns in one clump but each presumably of separate spore origin. Six percent of the total showed a considerable degree of ruffling and were classed as definite examples of this crispate condition. Less than one percent, two or three plants all together, showed cresting along the tips of some of the pinnae. Four plants were much broader,

fuller, and taller than the average type. No plants which seemed to be distinctly smaller, dwarfed, were noted nor were any two pinnate forms seen. About two percent were classed as incised, though not deeply. Plants of the different types were taken up for transportation to the Brooklyn Botanic Garden for further observation of their characters this year, if they have survived transplanting and the winter. The suggestion is made to others who may have the opportunity and interest to make careful note of the frequency of such differences. The Christmas fern is particularly interesting because of its abundance, its relatively simple, once pinnate form, and the fact that it furnishes an opportunity for comparison with the variation in the once pinnate Nephrolepis forms.—R. C. BENEDICT.

MANY-SPIKED LYCOPODS.—The note by Prof. O. E. Jennings[1] on a specimen of *Lycopodium complanatum* var. *flabelliforme* with 7 spikes brought to mind a number of many-spiked lycopods which I collected in New England some years ago. A Christmas visit home having afforded a chance to examine my herbarium, I present the following records of lycopods with an unusual number of spikes.

Lycopodium obscurum L.—The typical form of this species rarely has more than 6 or 7 spikes, which sometimes attain a length of 5.5 cm., and are occasionally prolonged into a sterile branch about 1 cm. long. A specimen collected at Holden, Mass., in 1912, bears 10 good spikes.

Lycopodium obscurum var. *dendroideum* (Michx.) D. C. Eaton.—This variety is usually more fruitful then the typical form. I have several plants from southern New Hampshire and Massachusetts bearing 20 to 27 spikes,

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[1] Amer. Fern Journ. **9:** 119. 1919.

and one specimen collected in 1909 on Temple Mount, Hillsboro County, N. H., with 31 spikes.

Lycopodium complanatum var. *flabelliforme* Fernald.—Eight-spiked peduncles do not seem to be very rare in this variety. I have several of this sort from Massachusetts and southern New Hampshire, and a single specimen collected in a partly cleared place in woods in Avon, Mass., with a peduncle bearing 9 small but perfect spikes. Another specimen, collected in Stoughton, Mass., has a peduncle with the usual 4 spikes, but two of these are bifid and two trifid to the middle, and each of the divisions is tipped with a short sterile branch densely covered with minute, awl-shaped leaves. Another specimen on the same sheet has 3 of the 4 spikes trifid.

The prize for finding many-spiked specimens of *flabelliforme* must be awarded to Miss M. A. Marshall, who has recorded[2] a specimen bearing 25 spikes on the two peduncles which terminate the fruiting stem. Through the courtesy of Miss Marshall, I have been able to examine this specimen, which was collected at Bolton, Mass., Oct. 19, 1919. One peduncle of this plant is forked about 2 cm. above the base, and each branch is again forked 7 to 10 mm. above. The four main branches bear 2, 4, 4, and 3 perfect spikes, a total of 13. These are normally formed but rather small, measuring only 1.5 to 1.8 cm. The other peduncle bears 12 spikes of the same size. Another specimen collected at the same time has peduncles with 6, 7, 8, 8, 9, and 10 spikes, the largest 2 cm. long.

Lycopodium tristachyum Pursh.—As in *L. complanatum* var. *flabelliforme*, the peduncles in this species are usually 4-spiked, but 8 spikes are not rare. A specimen in my herbarium from Hartland, Vt., collected by H. G. Rugg, bears 9 spikes, one of them bifid, and another from

[2]Amer. Fern Journ. 12: 24. 1922.

Sharon, Hillsboro County, N. H., collected by the writer, has a 9-spiked peduncle with two of the spikes bifid. Another specimen from Temple, N. H., bears two peduncles, one 5-spiked, the other 4-spiked. On the former two of the spikes are bifid and one trifid, and on the latter one of the spikes is bifid and obscurely trifid, and another is distinctly 6-fid at apex.—S. F. BLAKE, *Bureau of Plant Industry, Washington, D. C.*

"Deer fern, the new California fern, . . . fresh from the redwoods every day"; so runs an advertisement in a florists' magazine; referring presumably to *Blechnum Spicant* which is common on the west coast. In the same magazine the leaves of our eastern cut fern species, the fancy and dagger ferns, respectively *Dryopteris intermedia* and *Polystichum acrostichoides*, are now offered for four or five dollars a thousand, a price averaging more than double the prices of a few years ago. Does this mean merely that last year was a poor season with a short crop, or is it indicative of a depleted natural supply with permanently higher prices? We may hope that the higher price may be permanent, not as indicative of a disappearing wild growth, but as a possible cause of a reduction in the use of these leaves to a point where the wild growth may keep pace with the trade requirements.—R. C. B.

RUFFLING AS A DISTINCT TYPE OF LEAF VARIATION.—The illustration accompanying this note shows pinnae of five varieties of ferns distinguished from their respective wild types by their ruffled character, a condition technically known as crispation. In each case the normal form possesses pinnae with entire or merely faintly toothed margins, and with practically smooth or plane surfaces. A high development of the frilled condition seems always to be accompanied by the irregular lobing

of the margins so well represented in the photographs. Crispate varieties are usually less fertile among ferns; one *Pteris*, *P. cretica Childsii*, is always sterile. It would appear that so much nourishment is needed to produce the excess leaf-tissue that material for the development of spores is diverted elsewhere.

Among the Boston fern varieties ruffling occurs frequently as a bud mutation, adding considerable beauty to individual leaves, but rendering them somewhat softer and less resistant under house culture. Ruffling also occurs and has been preserved in the form of cultivated varieties of many other genera. In the illustration, the largest pinna, at the left, is *Polypodium* (*Phlebodium*) *aureum Mandianum*. The upper middle pinna is from the "Wm. K. Harris" variety of Boston fern (*Nephrolepis*), while the upper right pinna is another Nephrolepis, *N. hirsutula superba*. The broad glossy pinna below is from the Rochford holly fern, (*Cyrtomium falcatum Rochfordianum*); the fifth pinna shows another polypodium, *P.* (*Goniophlebium*) *subauriculatum Knightae*. The occurrence of ruffling does not seem to be conditioned on any particular type of veining; three of the types shown are net-veined, two are free. Seed plants offer what looks to be the same variation, as in *Malva crispa*, chicory, forms of lettuce, et al.

Among our wild ferns, ruffled plants are not infrequent in the Christmas fern. In England, some of the cultivated forms of hart's tongue are crispate. A point to be emphasized is this connection is that ruffling may be considered as a distinct mutation, not merely a temporary fluctuation due to growth conditions. Ruffled varieties under poor cultural conditions tend to resemble the normal smooth leaved types but that they do not lose the inherited basis of the frilled condition is demonstrated when good culture is again supplied.

Ruffled Forms of Ferns

For garden plants the ruffled forms would generally be more desirable than the crested or forked types and it is suggested that readers may find it worth while to be on the lookout for them. The character is most easily recognized when it modifies the simple or once pinnate condition but it seems to be present among *Nephrolepis* forms of all grades of division.—R. C. BENEDICT.

As a matter of interest to FERN JOURNAL readers, it may be noted that the market for fancy and dagger ferns (respectively *Dryopteris intermedia* and *Polystichum acrostichoides*) is down to former standard wholesale prices, two dollars a thousand leaves. Last year, 1922, through several untoward conditions it stood generally at four dollars. The inference is that the supply is still abundant and accessible.

The states of Wisconsin and Illinois have fallen into line on the matter of wild plant conservation. The former has enacted the following law, effective May 17, 1923:—

CHAPTER 138, LAWS OF 1923.

AN ACT to create section 4441B of the statutes, relating to the protection of the American lotus and providing a penalty.

The people of the State of Wisconsin, represented in senate and assembly, do enact as follows:—

Section 1. A new section is added to the statutes to read:

Section 4441B. Any person who shall wilfully cut, root up, sever, injure, destroy, remove or carry away from public property or public waters or from the property of another, without the permission of the owner or person entitled to possession, any American lotus, or who shall wilfully sell, expose for sale or purchase any flowers, roots, seedpods, bulbs or whole plants of any American lotus so gathered or taken shall be punished by imprisonment in the county jail not more than six months or by fine not exceeding one hundred dollars.

Section 2. The State Conservation Commission and its deputies shall have the same police and enforcement powers in respect to this section as it has in respect to the provisions of Chapter 29 of the statutes. It shall erect or cause to be erected in suitable places in public waters or public property where the American lotus is found substantial and permanent signs warning all persons against violations of this section. It may also erect or cause to be erected similar signs on private property with the consent of the owner thereof.

Section 3. This act shall take effect upon passage and publication.

The following more general act became law in Illinois on July 1, 1923.

An Act for the Conservation of Certain Wild Plants in the State of Illinois.

Section 1. Enacted by the people of the State of Illinois represented in the General Assembly: Any person, firm or corporation who shall, within the State of Illinois, knowingly buy, sell, offer or expose for sale any blood root (Sanguinaria canadensis), lady slipper (Cypripedium parviflorum and Cypripedium hirsutum), columbine (Aquilegia canadensis), trillium (Trillium grandiflorum and Trillium sessile), lotus (Nelumbo lutea), or gentian (Gentiana crinita and Gentiana Andrewsii), or any part thereof, dug, pulled up, or gathered from any public or private land, unless in the case of private land the owner or person lawfully occupying such land gives his consent in writing thereto, shall be deemed guilty of misdemeanor, and shall be punished by a fine of not less than $10.00 nor more than $100.00 and costs.

Section 2. All prosecutions under this act shall be commenced within six months from the time such offense was committed and not afterwards.

These acts are here given in full for their possible usefulness to persons who may be trying to secure similar legislation in their own states. Also, the President of the Illinois Chapter of the Wild Flower Preservation Society of America writes that her chapter is now "in the throes of giving publicity to the new law and seeing about enforcing it." The JOURNAL is happy to add its mite toward the publicity.

American Fern Society

New Members:—

Benedict, J. E., Jr., 945 Pennsylvania Ave., Washington, D. C.
Gilmore, Mrs. Elizabeth, 1419 Mahoning Ave., Youngstown, O.
Halsey, Miss Alice, Garrison-on-Hudson, N. Y.
Landreth, W. G., Lancaster, Pa.
Lee, Miss Eva M., Dept. of Botany, The University, Bristol, England.
Taylor, Dr. A. M., Newcomb College, New Orleans, La.
Van Everen, Mrs. Horace (Alice B.), 13 Kirkland St., Cambridge, Mass.
Willis, Warren J., Apt. 4, 2221 35th Place, Washington, D. C.

Changes of address:—

Ackley, Mrs. H. C., 5043 Royal Drive, Eagle Rock, Los Angeles, Cal.
Burgin, Herman, 204 Rittenhouse St., Germantown, Philadelphia, Pa.
Floyd, F. C., 52 Farquhar St., Roslindale, Mass.

The Judge of Elections, Rev. John Davis, reports the re-election of the present officers to serve during 1924.

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ERRATUM

Page 30, line 18, for "as forms", read "of forms".

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American Fern Journal

Vol. 14 JANUARY-MARCH, 1924 No. 1

Ferns of Eastern West Virginia. II

Fred W. Gray

In an article by this title published in Vol. 13, No. 4, Dr. Edgar T. Wherry has outlined some of the features of the distribution of ferns in West Virginia. It is here proposed to furnish notes on the species and varieties found in the four southeastern counties, Summers, Monroe, Greenbrier, and Pocahontas.

The following are believed to be new to the State, as they are not included in Millspaugh's Flora of 1913, nor in any later publication known to the writer:

Lygodium palmatum (Bernh.) Swartz.

Polypodium virginianum, forma deltoideum (Gilbert) Fernald.

" " " bipinnatifidum Fernald.

" " " elongatum (Jewell) Fernald.

" " " cambricoides F. W. Gray.

Dryopteris marginalis, forma elegans (J. Robinson) F. W. Gray.

" cristata × intermedia Dowell.

" intermedia × marginalis Benedict.

Athyrium angustum (Willd.) Presl.

Camptosorus rhizophyllus, forma angustatus F. W. Gray.

Asplenium platyneuron, forma serratum (E. S. Miller) R. Hoffmann.

" bradleyi D. C. Eaton.

" ruta-muraria L.

Data are now given as to the occurrence of these, as well as of the species previously known in the State, but

[Vol. 13, No. 4 of the Journal, pages 104–137, plate 4, was issued Jan. 21, 1924.]

found also in this section, some of them under unusual circumstances, or showing peculiar features. Where not otherwise stated the species discussed occur practically throughout the four counties. A few localities are mentioned in Millspaugh's Flora for some of these species in this section, but apparently little fern collecting has been done through these counties.

The arrangement of the species and of their names followed below has been suggested by Dr. Wherry.

SCHIZAEACEAE

LYGODIUM PALMATUM (Bernh.) Sw.—The station for this species was first reported to the writer by Miss Marian Scott Franklin. On searching the reported location it was found, near Lewisburg, in well drained, sandy soil along a shady roadside at 2570 feet altitude. It does not appear to have been published heretofore from West Virginia, the nearest previously known localities being Michaux's "western Virginia on the border of Kentucky," and Williamson's in Rockcastle and Laurel Counties in southeastern Kentucky.

OPHIOGLOSSACEAE

BOTRYCHIUM DISSECTUM Spreng.—Rare. Wayside, Summers County.

BOTRYCHIUM OBLIQUUM Muhl.—With the preceding.

BOTRYCHIUM VIRGINIANUM Sw.—Ascends to 4000 ft. in Pocahontas County.

OSMUNDACEAE

OSMUNDA CINNAMOMEA L.—On Muddy Creek Mt., has fronds 6½ feet long.

OSMUNDA CLAYTONIANA L.—Common.

OSMUNDA REGALIS var. SPECTABILIS (Willd.) A. Gray.—Common in swamps and along streams. It has also been observed in Monroe and Summers Counties to

grow on apparently dry cliffs, at times 30 feet from the base; but when the clumps were examined a seep, drip, or tiny spring proved always to accompany them.

POLYPODIACEAE

1. GENERA WITH MUCH CONTRACTED FRUITING FRONDS.

ONOCLEA SENSIBILIS L.—Fairly common. Ascends to 4100 ft. on Cranberry Mt.

2. GENERA WITH FRUIT IN MARGINAL ROWS.

PTERIDIUM LATIUSCULUM (Desv.) Maxon [*"Pteris aquilina"*].—Common on poor acid soil, but not observed on limestone. Ascends to 4800 feet on Bald Knob, Pocahontas County.

ADIANTUM PEDATUM L.—Common.

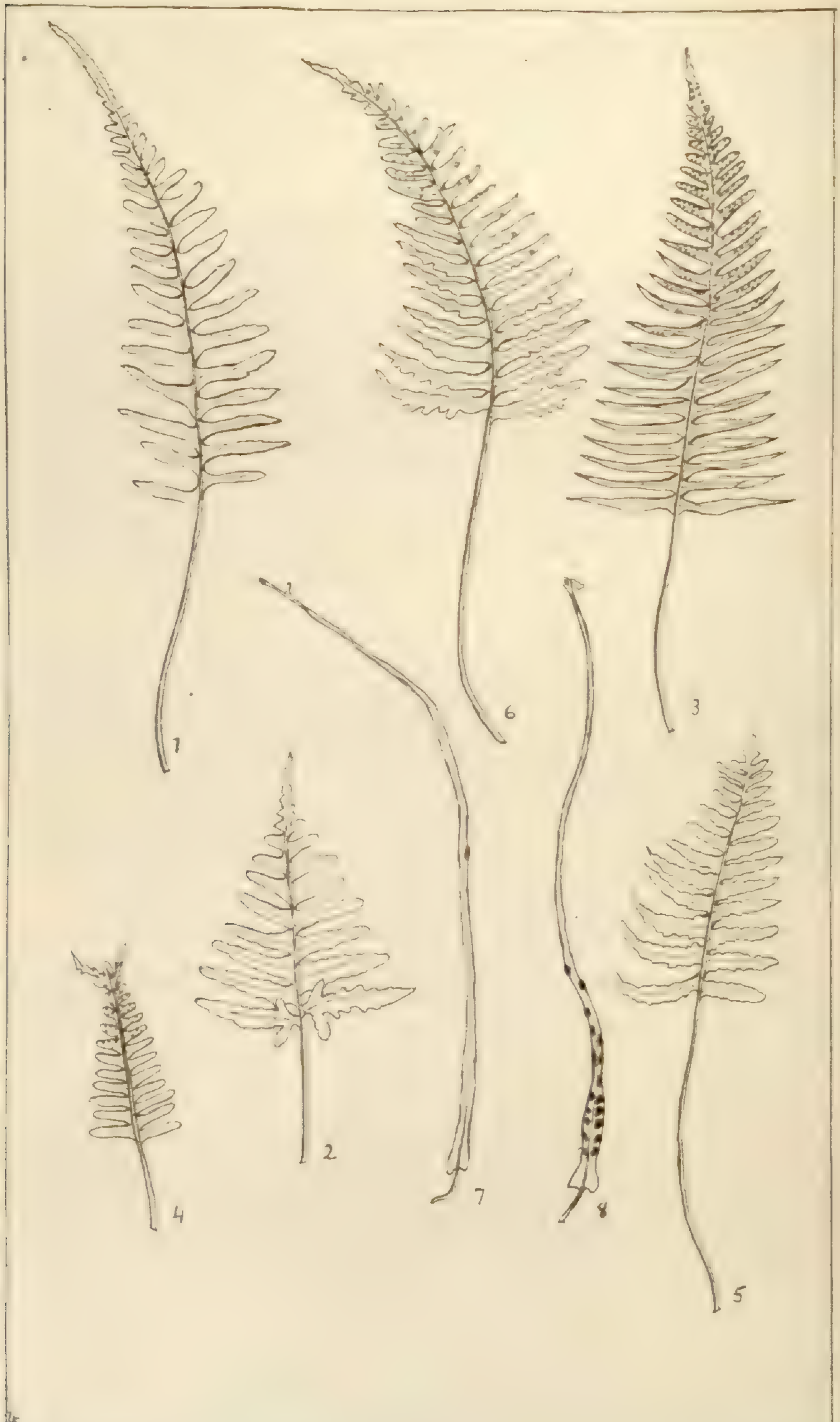
PELLAEA ATROPURPUREA (L.) Link.—In Monroe, Greenbrier, and Pocahontas it is frequent on limestone, also on shale cliffs in abundance at Indian Mills, Summers County, and sparingly at Bowes, Greenbrier County. Dr. Wherry calls my attention to its common occurrence on shale, as well as in the crevices of old walls, around Harpers Ferry, Jefferson County.

CHEILANTHES LANOSA (Michx.) Watt.—Rare, collected only at cliffs below Keister, Greenbrier County, and Indian Mills, Summers County, on shale in partial shade.

3. GENERA WITH ROUND FRUIT DOTS, COVERED BY A ROUND OR KIDNEY-SHAPED INDUSIUM, OR NAKED.

POLYPODIUM VIRGINIANUM L. [*P. vulgare*].—Common.

POLYPODIUM VIRGINIANUM, forma ACUMINATUM (Gilbert) Fernald.—Found on boulder in spruce forest at 4000 feet elevation near Cass. The practically entire acuminate segments are well shown in fig. 3, plate 1. This form is not new to West Virginia, for *"P. vulgare deceptum"* Maxon, first described from further west in



Forms of Polypodium virginianum

the State, seems clearly to belong here. The following forms are, however, definitely new to the State:

POLYPODIUM VIRGINIANUM, forma DELTOIDEUM (Gilbert) Fernald.—Near Cass and Spruce, Pocahontas County, and near Alderson, Greenbrier County. The triangular shape and the presence of spurs, sometimes as much as ¾ of an inch long, are characteristic. These specimens are intermediate between Gilbert's "*Polypodium vulgare*, forma *deltoideum*" and "forma *hastatum*," confirming the correctness of Fernald's view that these forms are not separable. A typical specimen is shown in fig. 2, plate 1.

POLYPODIUM VIRGINIANUM, forma BIPINNATIFIDUM Fernald.—Pocahontas County, near Cass, at 4000 feet elevation, on boulders in spruce forest. The cutting of the segments in the specimens referred here is rather shallow, but they are regarded as falling under the definition "more *or less* pinnatifid." The lobes are at times developed on both sides of the segments, again only on the lower sides of the lower ones, which are falcate in shape; however, these two forms are not distinct enough to deserve separate names; they are shown in figs. 5 and 6, plate 1.

POLYPODIUM VIRGINIANUM, forma **cambricoides,** nova forma.—In Professor Fernald's study of the distinction between *Polypodium vulgare* and *P. virginianum*[1] it was pointed out that nothing comparable with the English *P. vulgare*, var. *cambricum* had been found in eastern North America. However, near Peterstown, Monroe County, the writer has collected plants with fronds of the "cambricum" type, namely, deeply bipinnatifid (or tripimatifid at the base), with the teeth greatly elongated (2–3 cm. long) so as to overlap those on adjoining segments, and acute or acuminate. It is so dis-

[1] Rhodora, **24:** 125–142. 1922.

Polypodium virginianum, forma cambricoides

tinct from the forma *bipinnatifidum* in the extreme elongation of the teeth and their acute tips that it should receive a separate name, and that here proposed refers to its resemblance to the "Welsh polypody" a resemblance which will at once be evident on comparing its figure (plate 2) with those in books on British ferns. The type specimens of this form have been deposited in the herbarium of the American Fern Society.

POLYPODIUM VIRGINIANUM, forma ELONGATUM (Jewell) Fernald.—Pocahontas County, near Cass and Spruce. Large thrifty fronds with elongated tips. The ones near Cass have tip two inches long with row of fruit dots on either side of the rachis. Those near Spruce have a narrower elongated tip, with no fruit dots on tip. While these West Virginia specimens are not as extremely elongated as is the type of this form, they are included here as representing a strong tendency toward this sort of variation. **Fig. 1, plate 1.**

POLYPODIUM VIRGINIANUM, other forms.—In Greenbrier County, near Alderson, occur plants with the tips of the fronds irregularly forked; in Pocahontas County, near Cass, one colony has irregularly, and two have evenly forked fronds. The latter type of forking is shown in fig. 4, plate 1. Some specimens have also been found with the lower segments forked, approaching the "forma *alato-multifidum*," but they are hardly typical. There are also intermediates connecting the several listed forms.

PHEGOPTERIS POLYPODIOIDES Fée. ["*Dryopteris*" or "*Thelypteris Phegopteris*"].[2]—Near Spruce, Pocahontas

[2] It has been shown by Christensen that the old genus *Phegopteris* is not sharply separable from the genus for which he took up the name *Dryopteris*, but for which the name *Thelypteris* has now been shown to have clear priority. While admitting that from a world-wide viewpoint *Phegopteris* is only a section of the

County, at 3800 to 4000 feet altitude, in dense spruce woods, also persisting in the open after the timber has been cleared. Observed by Dr. Wherry in Randolph County, north of Cheat Bridge, under *Abies* trees.

PHEGOPTERIS HEXAGONOPTERA (Michx.) Fée. [*"Dryopteris"* or *"Thelypteris hexagonoptera"*].—Common under 3000 feet elevation.

PHEGOPTERIS DRYOPTERIS (L.) Fée. [*"Dryopteris Linnaeana"* or *Thelypteris dryopteris"*].—Near Spruce, Pocahontas County, at 3800 feet altitude in moss on rotten logs in half open swamp. Found also by Messrs. Trudell and Wherry in Randolph County, south of Horton, on cut-over rocky hillside.

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott.—Common. Ascends to 4200 feet, near Spruce, Pocahontas County. In Greenbrier County, near Bowes, there occurs a form with the fronds very narrow and long, and the pinnae narrow and widely separated. Another form with forked fronds is fairly common in one locality near Cass, Pocahontas County.

POLYSTICHUM ACROSTICHOIDES, forma INCISUM (A. Gray) Gilbert.—Fairly common in Greenbrier and Pocahontas Counties.

THELYPTERIS PALUSTRIS Schott. [*"Aspidium"* or *"Dryopteris thelypteris"*].—Pocahontas County in

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genus *Thelypteris*, the undersigned favors the elevation of sections to generic rank in certain cases. In the present instance there are three sections which in eastern North America are so different that any beginner can distinguish them, and instead of uniting them all into one unwieldy genus *Thelypteris* it is believed that, in the interests of convenience (which after all is the purpose of any assignment of names to natural objects), they should be treated as three separate genera. These are then the beech-ferns, *Phegopteris* spp., the marsh-ferns, for which the name *Thelypteris* is retained, and the shield-ferns, which may be still classed as *Dryopteris* spp. **E. T. W.**

glady places, at Greenbank, Dunmore, Huntersville, and Cranberry Glades.

THELYPTERIS NOVEBORACENSIS (L.) Nieuwl. [*"Aspidium"* or *"Dryopteris"*].—Common.

DRYOPTERIS MARGINALIS (L.) A. Gray [*"Aspidium"* or *"Thelypteris"*].—Common.

DRYOPTERIS MARGINALIS, forma ELEGANS (J. Robinson) F. W. Gray[3].—New to the State. Collected in Monroe, Greenbrier, and Pocahontas Counties. Some fronds 13½ inches broad, with overlapping pinnae, and pinnules decidedly falcate, serrate, elongate, and acuminate toward base of frond.

DRYOPTERIS GOLDIANA (Hook.) A. Gray [*"Aspidium"* or *"Thelypteris"*].—Monroe County, on Sartin Mt.; Pocahontas County, near Cass, where it ascends to 4500 feet. Also found by Dr. Wherry along the Staunton-Parkersburg Pike, where it crosses the Greenbrier limestone bed on the west flank of Shavers Mountain, Randolph County. Characteristically associated with *Athyrium angustifolium* and *A. acrostichoides*, among sugar maple trees.

DRYOPTERIS CRISTATA (L.) A. Gray [*"Aspidium"* or *"Thelypteris"*].—Pocahontas County at Greenbank, and in the Cranberry Glades, where it ascends to 3200 feet.

DRYOPTERIS SPINULOSA (Muell.) Kuntze [*"Aspidium"* or *"Thelypteris"*].—This species was collected only at Greenbank and Cranberry Glades, Pocahontas County.

DRYOPTERIS INTERMEDIA (Muhl.) A. Gray [*"Aspidium"* or *"Thelypteris"*].—Very abundant in Pocahontas County and in parts of the other counties under consideration, but apparently entirely wanting in sections of Monroe and Summers Counties.

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[3] DRYOPTERIS MARGINALIS (L.) A. Gray, forma **elegans** (J. Robinson), n. comb. *Aspidium marginale*, var. *elegans* J. Robinson, **Ferns of Essex Co., Mass., 151, 1875.**

DRYOPTERIS DILATATA (Hoff.) A. Gray ["*Aspidium*" or "*Thelypteris spinulosa*, var. *americana*"].—Pocahontas County, in spruce and hardwood forest; most plentiful above 4000 feet.

DRYOPTERIS hybrids.—The four hybrids listed at the beginning of this article occur with the parent species at several localities. Their identifications have been kindly confirmed by Dr. R. C. Benedict.

4. GENERA WITH ELONGATED FRUIT DOTS.

ATHYRIUM ANGUSTIFOLIUM (Michx.) Milde.—One station in each of Pocahontas, Greenbrier, and Monroe Counties on limestone, and one in Pocahontas on sandstone. Fronds more than 11 inches wide were collected near Cass, where it was growing in half open woods on limestone. Dr. Wherry found it under similar surroundings in Randolph County, where the Staunton-Parkersburg turnpike traverses the limestone bed on the west flank of Shavers Mountain.

ATHYRIUM ACROSTICHOIDES (Sw.) Diels ["*Asplenium thelypteroides*"].—Plentiful near Spruce and Cass, Pocahontas County. One station near Greenville, Monroe County. Dr. Wherry reports it from the west side of Shavers Mountain, Randolph County.

ATHYRIUM ASPLENIOIDES (Michx.) Desv. ["*Asplenium Filix-femina*" in part].—Common.

ATHYRIUM ASPLENIOIDES, forma SUBTRIPINNATUM Butters.—This fern, already reported from the State by Prof. Butters, was collected near Cass, Pocahontas County.

ATHYRIUM ANGUSTUM (Willd.) Presl ["*Asplenium Filix-femina*" in part].—Pocahontas County, and Greenbrier County near Alderson. This new report represents a distinct extension of range, for Prof. Butters[4]

[4] Rhodora, **19:** 190. Oct., 1917.

did not have this species from "south of the Potomac and Ohio rivers." That the writer's specimens are correctly identified with it is affirmed by Dean L. S. Hopkins.

CAMPTOSORUS RHIZOPHYLLUS (L.) Link.—Common on limestone throughout, also found on shale, sandstone, quartzite, and siliceous conglomerate.

CAMPTOSORUS RHIZOPHYLLUS, forma **angustatus,** nova forma.—Found in Monroe County near Alderson, growing in a crevice of a sandstone boulder in an open field, along with plants having normal shaped fronds. Characterized by short stipe, usually less than an inch long, and narrow laminae, less than 3/8 of an inch wide at base, sori practically at the margin of the fronds. Two typical fronds are shown in plate 1. figs. 7 and 8. The association of this form with normal plants suggests that it is not a mere starved or sunburnt form. The type specimens of this form have been placed in the herbarium of the American Fern Society.

ASPLENIUM PLATYNEURON (L.) Oakes.—Common.

ASPLENIUM PLATYNEURON, forma SERRATUM (E. S. Miller) R. Hoffmann.—Greenbrier County, below Ronceverte, on exposed cliff; apparently this form has not hitherto been reported from the State.

ASPLENIUM RESILIENS Kunze [*A. parvulum*].—In addition to the locality at Second Creek mentioned by Dr. Wherry in the preceding article, this species has been found at Fort Springs, Ronceverte, and Alderson, Greenbrier County, and at Greenville, Monroe County, where at one place it is growing 30 feet back from low entrance of a cave.

ASPLENIUM TRICHOMANES L.—Fairly common on shale, sandstone, and quartzite. Observed also on limestone where it seems to thrive in drier and more exposed situations than on other rocks.

ASPLENIUM PINNATIFIDUM Nuttall.—In Greenbrier and Monroe Counties, on conglomerate and sandstone cliffs and boulders, thriving best in shade. On Sartin Mt., Monroe County, were found fronds 11 inches long, with pinnae 2 inches long.

ASPLENIUM BRADLEYI D. C. Eaton.—This fern, not hitherto reported from the State, has been found in Greenbrier County, on the sandstone cliffs of Muddy Creek Mt., in dry shady sheltered shelves. It varies considerably in form, some fronds reaching 10 inches in length.

ASPLENIUM MONTANUM Willd.—Common on sandstone cliffs, and found on shale and quartzite; especially common on cliffs of Flat-Top Mountain, Greenbrier County, where the writer collected one frond 9½ inches long, and 5 inches broad, and tripinnate at the base.

ASPLENIUM RUTA-MURARIA L.—A new species for the State; apparently very rare, as it has been collected at but one place, in Greenbrier County, on limestone cliffs below Ronceverte.

5. GENERA WITH FRUIT DOTS SURROUNDED BY MORE OR LESS CUP-LIKE INDUSIA.

DENNSTAEDTIA PUNCTILOBULA (Michx.) Moore.—Common, except in parts of Monroe and Summers Counties.

WOODSIA OBTUSA (Spreng.) Torrey.—Occasional in Pocahontas and Greenbrier on, and at base of, shale and limestone cliffs. Most plentiful in Monroe and Summers Counties, where the preceding species is wanting.

CYSTOPTERIS FRAGILIS (L.) Bernh. ["*Filix*"].—In Pocahontas County, on disintegrating limestone and shale cliffs.

CYSTOPTERIS BULBIFERA (L.) Bernh. ["*Filix*"].—Common on moist limestone.

In conclusion the writer wishes to thank those who have aided him in the preparation of this paper by identifying specimens and helping in the arrangement of the data, and in particular Mrs. C. A. Weatherby for the outline drawing and Dr. R. C. Benedict for the photograph used as illustrations.

CASS, W. VA.

Proliferation of Asplenium platyneuron (L.) Oakes

F. G. FLOYD

I have read with much interest Miss Marshall's carefully written article (AM. FERN JOUR. **13:** 7–13) entitled "Proliferous Ebony Spleenwort," in which she describes finding a form of *Asplenium platyneuron* with young plants growing attached to the rachis of the sterile fronds from axils of the lower pinnae. She concludes by saying—"Who can tell the cause of this curious variation from the type?" In the vernacular there is an expression, familiar perhaps to some, to the effect that one is "willing to try anything once." In this spirit, I "take my pen in hand to drop you a few lines," bearing in mind however, the adage that "fools rush in where angels fear to tread." With a firm determination and no evasion of mind whatever, I shall endeavor to steer a middle course, realizing the futility of claiming kin with the heavenly host, and not relishing the alternative.

Miss Marshall's question postulates the theorems that, (1) *Asplenium platyneuron* without proliferation is the type, and (2) *Asplenium platyneuron* with proliferous axillary plants is a variation from the type or a variety. Are we justified in this assumption? Let us marshal the facts. D. C. Eaton describes (*Bull. Torrey Bot.*

Club **6:** 307) the proliferous plant, *Asplenium ebeneum* Ait., var. *proliferum* D. C. Eaton. He *discovers* he collected one plant in Florida "many years ago." Capt. Smith collects three proliferous fronds near Ocala, Fla., with others. It is evident from Eaton's note that the proliferous character was unknown when the plants were collected. C. E. Waters detects the variety (*Rhodora* **5:** 272) near Baltimore, Md., one plant "while cleaning the roots of a specimen." He found another plant (*Rhodora* **6:** 210) "while preparing to mount an unusually fine plant." Eleven plants found at McCall's Ferry, Pa. "Ten of these were found in a space six inches square." Two more plants found on the steep side of a railroad cut. Miss Marshall finds the form (AM. FERN JOUR.: **13:** 9) in a basement at Woodstock, Ct. "Of seventy-five mature and fruited plants examined twenty-five by actual count bore the little plants near the base of the stalks." This completes the published record. In addition to these it has been found once by myself. In July, 1903, I made my first trip to Lake Dunmore, Salisbury, Vt.,—a stranger in a strange land. It was not permitted that I be included in the party of illustrious Vermont botanists that—but that is another story. Every cloud has a silver lining, and perhaps it was just as well, because, thrown on my own resources, I found something *new to the state* (a new Vermont Flora is now due). I found this so-called var. *proliferum*, but I didn't know I had found it till later. Waters's note in *Rhodora* appeared in Nov., 1903, and an examination of my unmounted Lake Dunmore material showed that of sixteen specimens collected six bore well developed proliferous plants.

To recapitulate, there have been eight collections of this so-called variety by five indivduals, extending from Florida to Vermont. Twice only have growing plants

been observed: "ten plants in a space six inches square" and "of seventy-five plants examined twenty-five by actual count bore the little plants." Six out of sixteen of my chance Dunmore collection were found proliferous. Data are somewhat meager, to be sure, but the conclusion can hardly be denied that this so-called variety is well distributed and not uncommon. As Waters puts it, "plainly this form is not rare, but has merely been overlooked by collectors." This is very true. The proliferous plants are extremely tiny and delicate and completely hidden in the dense basal rosette of sterile fronds. We call this condition "*var.*" *proliferum* because it was so christened; and that seems to be the only excuse for the name today. Eaton was, of course, justified in giving it varietal distinction because it was then considered a sporadic or aberrant form, but in the light of present-day knowledge, and having in mind its abundance and wide distribution, we recognize that this proliferation is simply an inmate natural element of the species itself, *Asplenium platyneuron*, a trait, a "decided tendency," as Waters puts it, or, in other words, the nature of the beast. The species *Asplenium platyneuron* (L.) Oakes and *Camptosorus rhizophyllus* (L.) Link are in exactly the same category. Both produce proliferous offspring not infrequently, but yet not invariably. No distinctive name for proliferous forms of *Camptosorus* has been proposed. To be consistent, then, should we not relegate our so-called "var." *proliferum* of *Asplenium platyneuron* into a deserved oblivion and enroll our Ebony Spleenwort among those species having proliferous forms? I might also add that two other species, × *Asplenium ebenoides* R. R. Scott and *A. pinnatifidum* Nutt., also produce proliferous forms, yet neither of these has a varietal or formal designation.

But this does not answer Miss Marshall's question.

Why did the plants of *A. platyneuron* that she observed in the basement at Woodstock, Ct., form the proliferous plants? The colony is known to have occupied the basement station for many years. On her first visit the plants were seemingly healthy, but four months later when she made her second excursion, the colony was not in good condition and subsequent trips indicate ultimate extermination. Probably before she first saw the plants the factor responsible for their destruction was at work. I believe it is a well understood phenomenon that when the life of a plant is threatened it immediately tries to effect reproduction by every means within its power. Presumably this was the case with Miss Marshall's Woodstock colony of *Asplenium platyneuron*. These plants were threatened and they were having recourse to the latent method of reproduction by means of proliferation as well as by the more usual method of producing spores. They were trying to perpetuate themselves in every way they could.

In connection with my Lake Dunmore collection, there are a few further notes that seem interesting and worthy of record. I am sorry to say that the plants themselves are in my herbarium, which is not at present available. Consequently I have not been able to inspect them at this writing. Referring to my field note book under date of July 27, 1903, I find three Ebony Spleenwort items, nos. 1481, 1482, 1483. The first comprises absolutely normal plants of *A. platyneuron*. The second, no. 1482, includes *A. platyneuron* bearing proliferous offspring. I have seen no record of multiple proliferation; all mention but one offshoot to a plant. I quote from my note book under no. 1482. "One plant has a frond (proliferous) 9 cm. long. The same plant shows two smaller (proliferous) plants." Making three of the small plants on one mature specimen. In all previous records *sterile*

fronds bore the derivative plants. No mention is made of the phenomenon occurring on *fertile* fronds. I quote again my record under no. 1482. "Two plants show a development at the axils of the lowest pinna of *fertile* fronds that would develop into new plants." Mr. George E. Davenport, the eminent fern student, passed upon the material listed in my note book under no. 1483 and named it *Asplenium ebeneum* Ait., var. *serratum* Gray, synonymous with *A. platyneuron* (L.) Oakes, var. *serratum* (E. S. Miller) BSP. of the Manual. I can do no better than quote the entry. "Fronds thin. Plants very tall, finely fruited and sharply and quite deeply serrate. Two are proliferous from the lower axils and each of these has *fertile* pinnae proliferous. One of these plants has two fertile fronds, one being serrate and the other quite normal. The former frond is serrate only in the upper part where the pinnae are long and doubly auricled, one on top and one at the bottom."

ROSLINDALE, MASS.

Recent Fern Literature

One of the questions in regard to the horticultural varieties of the Boston fern has been whether they could maintain themselves under natural conditions. This has now been partly answered by Mr. Charles T. Simpson, a fern-grower of Little River, Florida. He reports that a very few plants of var. *Whitmani*, turned out into a hammock near his establishment about twelve years ago, have persisted and increased until they cover irregularly over ten square rods of the forest floor, and in some cases have climbed a foot or so up the trunks of trees. At least three-quarters of the plants retain the *Whitmani* form fairly well.[1]

[1] Benedict, R. C. Artificial varieties under natural conditions. Journ. Heredity **14:** 115–117, pl. 1. June, 1923.

Mr. Henry Mousley writes interestingly of various excursions to points in the vicinity of Hatley, P. Q. They resulted in the discovery of five species new to the region: *Thelypteris spinulosa*, *Botrychium lanceolatum*, var. *angustisegmentum*, *Woodsia ilvensis*, *Cryptogramma Stelleri* and *Asplenium Trichomanes*. These five bring the list of Hatley ferns to a total of 32 species, four less than Willoughby, Vt.[2]

In another note Mr. Mousley puts on record, very courteously, the fact that he discovered the alpine maidenhair (*Adiantum pedatum*, var. *aleuticum*) at Hatley about ten days before Mrs. Jolley's first finding of it at Mt. Orford, Quebec—though he did not realize what he had until an account of her find was published. He discusses the geology of the serpentine formation on which this fern occurs, and points out that its most constant character is the "strongly ascending pinnae with wing-shaped pinnules." Also, the teeth at the tips of the pinnules are usually acute; in typical *A. pedatum* they are more rounded.[3]

Prof. F. L. Pickett has published a study of the life history of *Cheilanthes gracillima*. This fern inhabits exposed ledges in the Pacific Coast region and is subject to great extremes of temperature and severe drought. Most of its growth is made in spring, after the winter rains. The spores, though mature, are retained on the fronds until the coming of the first autumn rains, which alternate with days of sunshine and dry winds, and are then shed. They germinate whenever there is sufficient moisture. Both spores and prothallia survive long

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[2] Mousley, Henry. Further notes on the ferns of Hatley, Stanstead Co., Quebec, 1921–22. Can. Field Nat. **36:** 149–152. Nov., 1922.

[3] The alpine maidenhair at Hatley. *Op. cit.* **37:** 84–85. May. 1923.

periods of drought. The former remained viable after more than two years' desiccation in the laboratory. The latter have no means of preventing loss of water from their tissues; they wilt, but they do not die. Some endured thirteen weeks of absolute drought in the laboratory and recovered after a few hours when water was supplied. They can also withstand winter conditions in eastern Washington. With this vitality is associated marked development of the power of vegetative propagation.[4]

The *Boston Globe* for Sept. 16, 1923, ran an illustrated account of the fern-picking industry in the vicinity of Jamaica and Londonderry, Vermont. It is stated that the industry has existed in that region for about fourteen years and is still flourishing, and that the record pick for one person in one day is 17,500 fronds.

STANDARDIZED PLANT NAMES. Salem, Mass.—Is it possible to standardize plant names? Is it desirable? An affirmative answer to the second question scarcely admits of discussion. To the gardner, amateur or professional, and similarly to the botanist, and to anyone who has any occasion to refer to specific plants, a standardized system of names intelligible to everyone would form a common ground, a sort of common language, the convenience of which cannot be overestimated. For many years scientists have been struggling to reach some basis of agreement in the form of a code of rules by which the methods of determining the most acceptable names might be settled.

In horticulture, among florists, and among the laymen who buy horticultural products, the confusion of names

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[4] Pickett, F. L. An ecological study of Cheilanthes gracillima. Bull. Torrey Bot. Club **50**: 329–338, figs 1–31. Oct., 1923.

which has existed has meant considerable financial loss. The names used, for example, in florists' catalogues have included numerous duplications as well as actual mistakes so that a customer could have no certainty that in asking for some particular named form he would get the thing asked for. Reference was made in the FERN JOURNAL some years back to the fact that in one catalogue, a single genus of ferns was catalogued in different species under several generic names.

From the standpoint of American horticulture, the question as to the possibility of a standardized plant list has been answered by the appearance of the book named above. This represents the work of the American Joint Committee on Horticultural Nomenclature, Harlan P. Kelsey, F. V. Coville, and F. L. Olmsted, representing the horticultural and landscape gardening interests, and the Department of Agriculture, and having the backing of all the influential organizations in commercial horticulture. In preparing the book, the work was distributed among specialists familiar with various groups of plants.

The specific aim of the committee was to adopt "a single standard scientific name and a single standard common name for every tree, etc., in American trade." It is to be universally followed by the organizations supporting the Joint Committee. At five-year intervals, the list will be open for any necessary revision upon due consideration by the committee but in the intervals, the members of the organizations agree to use the names of the standardized list.

For fern students it has the interest that the standardized list of fern names was in Dr. Maxon's charge, and that it comprises a large proportion of the native American species, as well as those in the trade as house plants.

Even the latest fern books and manuals give for *Osmunda Claytoniana*, forma *dubia* only the station in southern Vermont mentioned in Dr. Grout's original description. This being the case, it may be worth while to record two other localities at which, as shown by specimens now in the Gray Herbarium, this form has been collected. Miss Kate Furbish found it at South Poland, Maine, in 1895, and Mr. William Stout discovered a plant of it at Delaware Water Gap in 1878. It is even said in the Catalogue of Connecticut Plants (Bull. State Geol. and Nat. Hist. Surv. **14:** 26, 1910) to be occasional in that state. The writer suspects that this statement rests on a confusion of semisterile teratological forms, such as are likely to occur in any dimorphic fern, with the true forma *dubia* which is to be recognized by the widely spaced and often pinnatifid pinnules of the sterile pinnae rather than by any peculiarity of the fertile ones. However this may be, the collection of unmistakable specimens of the form at widely separated localities suggests that, like other forms of the same general character in other species, it may be expected to occur rarely wherever the interrupted fern is found, and that anyone interested has a chance of finding it if he looks long enough.—C. A. W.

AN OCCURRENCE OF THE SOUTHERN MAIDEN-HAIR IN MARYLAND.—On the stone wall built around a spring on the Noyes Estate in the new subdivision of Woodside Park, Montgomery County, Maryland, the writer discovered in the fall of 1922 a thriving plant of the southern Maiden-hair, *Adiantum Capillus-Veneris* L. The fronds shrivelled up during the winter but new ones came out the following spring, and when they appeared to have attained their maximum development, in July, were photographed and a few fronds collected. Shortly

thereafter the plant disappeared, having evidently been pulled up by some chance visitor; although the clearing of the land for building purposes would soon have obliterated the locality in any case.

Tests of the reaction of the material (a mixture of fragments of cement and decomposed moss) in whien the roots of the fern were imbedded, made by Dr. Edgar T. Wherry, showed a specific alkalinity of 10. The

spring water itself was neutral and the alkalinity evidently came from the decomposing cement.

How the plant got there in the first place can not be definitely determined, although there is a greenhouse less than half a mile away and the spores may well have come from there, one of them reaching by chance this favorable location on the spring wall. The noteworthy fact in the case is that this southern species was able to establish and maintain itself over one winter at least, so far north; the spring is located approximately ten miles north of Washington.—J. E. BENEDICT, JR., *Washington, D. C.*

NOTES ON THE SPRING GROWTH OF AZOLLA.—The following notes, supplementing the note on fall observations on *Azolla* reported in the FERN JOURNAL, vol. 13, pp. 48–52, may be recorded.

The brook bed in which the Azolla made so luxuriant a growth during the late summer and fall of 1922 was filled with water again in 1923 in April. No evidence of the persistence over winter of Azolla from the previous year was seen. Whether it would have been hardy if the brook had remained full is another question.

About the first of May a few plants of Azolla from the greenhouse were thrown into the upper end of the lower open sunny stretch of the brook. The weather was still cool and this first culture seems to have disappeared. On May 15th a few more plants were installed in about the same position, care being taken to put them among grass roots where they would not be likely to be carried off by the current.

In the first few days these plants which had been clear green assumed the bright red appearance of the fall, mainly as a matter of marginal coloration around each leaf. As the weather grew warmer, by June first, the extreme bright red was lost and the plants assumed approximately the same color they had last August and September, olive green except for a deeper margin.

With the advancement of much warmer weather in June the multiplication of colonies became very rapid; 20 odd colonies increased to over 200 in less than a month, counting only those which still remained in the situation in which they were introduced. Some probably had been coaxed out into the brook current and carried further down.

In the upper section of the brook where Azolla is regularly installed as an ecological illustration of water plants, multiplication was also extraordinarily rapid. A

small handful of plants increased in a few weeks to cover a surface of about a yard in diameter.—R. C. BENEDICT.

Heretofore such testimony as we have been able to gather has been to the effect that ferns are not damaged by picking for the florist trade. Mr. E. H. Clarkson, however, sends in a clipping from the *Rural New Yorker* of March 19, 1923, which sets forth the opposite view. "I notice," it reads, "that Mr. Farrington [the editor of *Horticulture*] thinks ferns are not injured by picking. It is the experience of fern pickers that after five seasons of continuous picking the bed is usually 'run out.' Fern banks that three or four years ago yielded over $50 this year yielded less than $2, so some banks deteriorate faster. The ferns grow fewer and smaller after the second or third picking.—MOTHER BEE."

A LIVING MEMORIAL TO ALVAH A. EATON.—The narrow-leaf chain fern (*Woodwardia angustifolia*), which is very rare in New England, grows abundantly in a small swamp at Seabrook, N. H., in company with the Virginia chain fern (*Woodwardia virginica*) and the Massachusetts fern (*Dryopteris simulata*). This is perhaps the most northerly station known for the little chain fern, and was discovered many years ago by Alvah A. Eaton.

Here also are a few cinnamon ferns, and a small patch of the bracken. The rather sparse young growth of trees, consisting mostly of American white birch (*Betula populifolia*) and red maple, gives the chain ferns just the mixture of sunlight and shade that they delight in, and they both produce an abundance of fine fertile fronds. The greenbrier (*Smilax rotundifolia*) and the high bush blueberry grow all about, with here and there a bush of *Viburnum cassinoides*. The soil is carpeted

thickly with the swamp black-berry (*Rubus hispidus*) and on the edge of the swamp is a patch of American cranberry.

Here in the north the little chain fern may produce many fine fertile fronds, but the spores—probably because the season is not long enough to properly ripen them—seldom produce any plants. In all three stations for *angustifolia* known to the writer in this vicinity, the area in which the ferns grow is small and the plants are comparatively close together. All the ferns seem undoubtedly to have originated from spreading by their branching rootstocks, by which, in a congenial soil, they increase very fast.

In the more southern parts of eastern North America this fern is much more common and more widely distributed. This is probably due to the longer season which results in the full ripening of the spores.—EDWARD H. CLARKSON, *Newburyport, Mass.*

JOSEPH LEIDY COMMEMORATIVE MEETING.—The Centenary Celebration of the birth of Joseph Leidy was held in the Academy of Natural Sciences in Philadelphia on Thursday, December 6, 1923. The American Fern Society was represented by its Secretary.

A large gathering of scientists and persons of note assembled in the Lecture Hall of the Academy to honor the memory of one who, for several decades during the last century, stood at the forefront of the naturalists, in the older meaning of the term, of America. A physician by profession and lecturer at the University, Dr. Leidy is best known for his contributions to zoological and to paleontological science. Dr. Herbert S. Jennings, of Johns Hopkins University, presented, in a brilliant address, Dr. Leidy's contributions in the former field.

while Dr. Scott, of Princeton, told how much paleontology owes to his studies. While chiefly known in these two fields, Dr. Leidy, as Dr. William B. Stone pointed out, was a botanist of no mean standing. His intimate knowledge of the plant life of the environs of Philadelphia is shown by his collections, and by the notes in the Proceedings of the Academy; while in several places even in his works on zoology and paleontology his intimate knowledge of the flora as well as the fauna of different parts of this country is disclosed. The opening address, after the words of welcome from Dr. Penrose, President of the Academy, was a delightful picture by Professor Edward S. Morse, of the Peabody Academy of Science, at Salem, Massachusetts, who gave as the clew to Dr. Leidy's life his intense interest in everything that pertained to nature and his charming graciousness to those who were students and so but tyros in the great field.

At the evening session, held at the College of Physicians, Dr. Henry F. Osborn delivered the "Joseph Leidy Lecture in Science," Dr. George E. deSchweinitz told in a most intimate and personal way of Dr. Leidy's work as an anatomist, and Dr. Hobart S. Hare closed the evening with an address on Leidy's influence on Medical Science.

At the close of the afternoon session Dr. Penrose announced that Dr. Leidy's nephew had endowed, under the care of the Academy, the Leidy Medal which, together with a certain monetary gift, is to be awarded every three years to the person who has made the most notable contribution to science.

A number of Dr. Leidy's instruments and notes, books and drawings were on exhibition. The latter show the artistic skill which led Dr. Jennings to point out that Dr. Leidy's great work had been the portrayal of nature in terms of artistic beauty.—C. S. L.

American Fern Society

Dr. Elias J. Durand, a member of the Society since 1911, died at St. Paul, Minnesota, Oct. 29, 1922. Dr. Durand was born at Canandaigua, New York, March 20, 1870. He was graduated from Cornell University and was instructor there until 1910. In that year he went to the University of Missouri as Professor of Botany, remaining until 1918, when he took a professorship at the University of Minnesota, where he served until his death. He was best known scientifically for his work in mycology and especially on the discomycetes.

Rev. Francis Goodwin, a member of the Society since 1916, died at his home in Hartford, Connecticut, Oct. 5, 1923. Educated and ordained as a clergyman, he had spent much of his life in the management, with his brother, of the large estate left by their father, and in serving the community in which he lived, both officially and in the many unofficial ways possible for a man of his means and public spirit. He was especially active in the development of Hartford's excellent system of parks, one of which bears his name.

Mrs. Clement B. Penrose, a member of the Society since 1900, died at her home in Germantown, Pennsylvania, Dec. 10, 1923, aged 88.

The Committee on plant conservation laws in New York State which was appointed at the meeting held at the Brooklyn Botanic Garden last May, and on which Dr. Benedict is serving as representative of the Society, has prepared a series of amendments to existing law for submission to the Legislature.

Report of the President for 1923

In offering a presidential report for the year just closed it is hardly necessary to do more than refer to the reports of the other officers and to suggest that members scan the pages of the four numbers of the JOURNAL for 1923, as indicating the extent of our activities. Reviewing Volume 13, one is impressed by the variety of the subject matter and by its stimulating and highly informative character. No field of fern study is neglected. Systematic notes, studies in variation and morphology, field experiences, habitat data, interesting reviews of literature, progress in wild plant conservation, regional fern-studies—all find their place in the volume, and an especially encouraging feature is noted in the larger number of contributors. Our net membership gain over the last preceding year is not great, yet the Society is more than holding its own in every way. This is owing more to the earnest work of the editors than to any other single factor. If we could provide them with a larger allotment of funds the JOURNAL would flourish even beyond its present condition. But funds, under ordinary circumstances, are available almost wholly from membership dues alone, and unless we bring in new members we can hardly hope to increase the size of the JOURNAL. A concerted effort to obtain 100 new members would be worth while.

Elsewhere in the JOURNAL will be found an account of the Joseph Leidy Centenary Celebration at the Academy of Natural Sciences of Philadelphia, in which the Fern Society participated upon invitation of the Academy and the other scientific bodies associated for the purpose. This honor was greatly appreciated, and the Secretary, Rev. C. S. Lewis, was designated as our representative on that occasion.

In connection with progress upon the wild plant conservation program it may be mentioned that a possible opportunity for good has arisen in an invitation extended by a general committee of florists' organizations looking to the coöperation of the Fern Society. Dr. R. C. Benedist, who is chiefly responsible for our stand in the interests of wild plant preservation, was appointed a committee of one to represent the Fern Society. He will doubtless report upon any steps taken.

Unfortunately it was not practicable to hold a fern meeting at the convocation of the American Association for the Advancement of Science at Cincinnati in December last. This year (1924) the Association meets in Washington during the Christmas holidays, and it is expected that the Society will hold one or more meetings. It is not too early to plan attendance, and it is urged that members communicate with the Secretary, stating the titles of papers and notes they are willing to present. A field trip to the interesting Great Falls region is planned, and a good attendance of members is hoped for.

Respectfully submitted,

WILLIAM R. MAXON, *President*.

Report of the Secretary for 1923

The secretary was appointed to serve, and was present as, a delegate at the Joseph Leidy Commemorative Meeting held in Philadelphia December 6, 1923. Several members attended the meetings of the American Association for the Advancement of Science at Cincinnati December 27, 1923, but it was impossible to arrange any regular meeting of the Society in connection with it.

During the year word has been received of the death of four members:—Judge Chas. F. Jenney, Rev. Francis

Goodwin, E. J. Durand, and A. W. Brown. Twenty-four members have been added, thirteen have resigned, and the total membership, Dec. 31, 1923, stands at 310; a gain of seven over last year. N. T. Kidder has become a life member.

It is proposed to prepare a new list of members who are enrolled at the present time. Any possible correction or changes of address should be sent to the Secretary as soon as possible.

CHARLES S. LEWIS, *Secretary.*

Report of the Editors for 1923

The JOURNAL has had an uneventfully prosperous year. Copy has been fairly abundant and reasonably diversified. With the aid of an extra appropriation given us by the Council, we have been able to run some ten pages above the regular allowance. We end the year with matter enough on hand for at least one full number. It includes the second installment of the article on West Virginia ferns, further notes on *Equisetum* by Prof. Schaffner, a discussion of the proliferous ebony spleenwort, described by Miss Marshall, from a new point of view, and the first of a series on "facts and fancies about ferns" which should interest us all, but especially our newer and less experienced members.

Illustrations have not been plenty this year. Next year will be different; we already have seven pictures on hand, and extra-illustrated numbers may be looked for.

Our message to the members is as usual. It is old, but never yet untimely. Don't think that because we have some copy, we don't want more. We have been gratified that so many responded to the question raised in regard

to *Botrychium dissectum*. But don't wait for a question. Send in to us anything about ferns which interests you. It will probably interest others also.

R. C. BENEDICT,
E. J. WINSLOW,
C. A. WEATHERBY,
Editors.

Once again the Treasurer's report is delayed owing to slowness in getting in the bills for the JOURNAL. News comes from the Curator that his house narrowly escaped destruction during a fire on the campus of Culver-Stockton College, and was saved only after all the furniture had been carried out. He doubtless has plenty to do just now without writing reports.

Report of the Judge of Elections

To the Secretary of the American Fern Society:

The undersigned, Judge of Elections, by the appointment of Vice-president Miss M. A. Marshall, acting President, respectfully presents the following Report of the balloting for officers of the American Fern Society for the year 1924.

Whole number of ballots cast	69
Number of complete ballots	68
Number of incomplete ballots	1
Necessary for choice	35

For President:—
Wm. R. Maxon 68

For Secretary:—
Chas. S. Lewis 68

For Vice-president:—
Miss M. A. Marshall 67
Rev. John Davis 1

For Treasurer:—
J. G. Underwood 68

I therefore declare the election of Wm. R. Maxon, President; Miss M. A. Marshall, Vice-president; Chas. S. Lewis, Secretary; and J. G. Underwood, Treasurer, of the American Fern Society for the year 1924.

JOHN DAVIS,
Judge of Elections.

New members:—

Beattie, Mrs. Robert H., 216 Overlook Road, Ithaca, N. Y.
Steagall, Mary M., 808 S. Illinois Ave., Carbondale, Ill.

Changes in address:—

Ferguson, William C., 37 Atlantic Ave., Hempstead, N. Y.
Long, Bayard, 250 Ashbourne Road, Elkins Park, Philadelphia, Pa.

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American Fern Journal

Vol. 14 APRIL-JUNE, 1924 No. 2

Notes on Arkansas Pteridophyta[1]

John T. Buchholz

The list of Arkansas ferns contained in the state plant list by Branner and Coville (1) is the most complete and recent list which has appeared, though this was based very largely on the previous excellent work of Harvey (3) on the Plant List of Lesquereux (2) and that of Nuttall (4). Harvey's was the first comprehensive list based on first hand investigation but it included only the Filicales. Recently a few additional species and varieties have been found, and a complete revised list will be published later when we have found from more numerous stations, all except the rarest species of Arkansas ferns, and can include more valuable notes on distribution. In this short paper, we shall call attention chiefly to changes and errors, also making several additions to the above mentioned lists.

With several exceptions nearly all of the ferns listed by Harvey and by Branner and Coville have been taken by the writer in various parts of the state though a few were sent to us by interested persons. Some of the species credited to Arkansas by Branner and Coville or by current manuals have been diligently searched for without success. This has led the writer to examine

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[Vol. 14, No. 1 of the Journal, pages 1–32, plates 1 and 2, was issued May 5, 1924.]

[1] University of Arkansas, Journal Series, No. 7.

specimens of these species in various herbaria of the country as occasion permitted, in the hope of locating stations for Arkansas material. The herbaria of the Missouri Botanical Garden, the New York Botanical Garden, and the National Museum were visited. Inquiries were sent concerning the occurrence of Arkansas specimens in the collections of the other larger herbaria which might contain Arkansas material, the Gray Herbarium and the Field Museum of Natural History.

The following facts have come to light from this study:

The *Ophioglossum vulgatum* L. collected by Harvey was without doubt *O. Engelmanni* Prantl, the species occurring in the Fayetteville region. However, *O. vulgatum* L. is found in the coastal plain country of Arkansas. A specimen from Fulton, Ark., April 12, 1910, (*Kellogg*) was mentioned by Palmer (5). Another specimen was noted from Arkansas Post March 1, 1909, also collected by Kellogg. This last named material is of special interest since Arkansas Post is the station at which Nuttall (1) first noted this species. Thus we have both species of Ophioglossum in Arkansas.

One of the current manuals lists *Pteretis Struthiopteris* (L.) Nieuwl. *(Onoclea Struthiopteris)* from Arkansas, but no herbarium specimen is to be found from this state in any of the herbaria consulted.

Polystichum acrostichoides, forma *incisum* (Gray) Gilbert is found in North Arkansas along with the typical form.

Dryopteris spinulosa (Muell.) Kuntze, was doubtfully mentioned but not collected by Harvey who stated that the information of its occurrence in Arkansas came from the Geological Survey. Branner and Coville list this species but we have not only failed to find it where it should occur, but have found no collection in the

five herbaria, and are very doubtful if it is found as far south as Arkansas.

Asplenium platyneuron, forma *serratum* (E. S. Miller) R. Hoffman is found in several places along with the typical form in Washington County. Mr. E. J. Palmer also has collection records of this variety at Cotter, Arkansas, and in Carroll County.

Asplenium montanum Willd. listed from Arkansas in all current manuals, has probably never been collected in the state. The evidence gained from a study of existing herbarium material would indicate that there is no *A. montanum* west of the Mississippi. Though the species was not claimed for Arkansas by Harvey or by Branner and Coville, its range is thus given in Gray's Manual, 7th Ed., in Britton and Brown's Illustrated Flora, in Britton's Manual, and in Small's Southern Flora. *A. Bradleyi* D. C. Eaton is occasionally met with in Arkansas and it may be that a small immature specimen of this was mistaken by someone for *A. montanum*, though no mislabeled specimens were noted by the writer in any of the collections consulted.

Pteridium aquilinum, var. *pseudocaudatum* Clute is the common species of Washington and Benton Counties.

Pellaea glabella Mett. has been taken in Benton county 5 miles Northwest of Bentonville at the "Bella Vista" summer resort, on the limestone cliff above the spring. This seems to be a station farther south than any other collections as noted by the writer in looking over material at the herbaria of the National Museum, of the New York Botanical Garden or the Missouri Botanical Garden.

Branner and Coville report *Cheilanthes Eatoni* Baker from "clefts in the rocks at Mountain Park, Big Rock, near Little Rock—Coville." Dr. Wm. R. Maxon has examined Coville's specimen No. 117 collected in 1887

(National Museum) and finds that it is *C. tomentosa* Link, not *C. Eatoni* Baker. *C. tomentosa* is found mostly on calcareous cliffs in various parts of the state, Hot Springs, Little Rock, Magazine Mountain, Maumelle Mountain, and numerous places in northwest Arkansas.

Polypodium virginianum L. is the Arkansas species rather than *P. vulgare* L. of Harvey's list according to Mr. Weatherby who examined some of the Harvey material from Northwest Arkansas. This species is somewhat rare.

Marsilea uncinata A. Br. is listed by Branner and Coville on the authority of Underwood (6) but no herbarium material was found in the herbaria consulted. In the third edition Underwood does not list *M. uncinata* from Arkansas but the following species. It is, therefore, very likely that an error in determination was made and that the following species was intended.

Marsilea vestita Hook & Grev. is found in Arkansas. A specimen was collected by Beyrich "from Arkansas" without local data in 1834 (Missouri Bot. Garden). *M. mucronata* Willd., reported by Lesquereux, as found by Nuttall, belongs here. A specimen from Nuttall is in the herbarium of the New York Botanical Garden.

Pilularia americana A. Br. was collected near Ft. Smith, Ark., by Nuttall. His specimen (Ex. herb. Elias Durand) is in the Herbarium of the Mo. Botanical Garden. No one has collected this water fern in Arkansas since, unless specimens are to be found in smaller or private herbaria or in collections abroad.

Azolla caroliniana Willd. is found in Northeastern Arkansas on the lakes and rivers about the St. Francis basin, possibly also at other points in Eastern Arkansas

Equisetum praealtum Raf. (*E. robustum* A. Br.; *E. hyemale robustum* (A. Br.) A. A. Eat.) is the common

species in Arkansas. It seems to be practically the only species collected in the state thus far. All of the material from Arkansas in the collection at the Missouri Botanical Garden was submitted to Prof. J. H. Schaffner to whom I am indebted for these identifications. These specimens included material from McNab, Hempstead Co., (*E. J. Palmer* No. 7200); Beaver, Carroll Co., (*E. J. Palmer* No. 5567); and a specimen from the N. M. Glatfelter Herb. collected near Beaver, Carroll County. The following collections from the University of Arkansas Herbarium were also submitted to Prof. Schaffner. Several specimens from Fulton and McNab, Arkansas, (*J. T. B.* No. 438), several from near Palarm, Pulaski County (*H. E. Wheeler*) and one from Osceola, Arkansas, (*H. E. Wheeler*). Typical *E. hyemale* L. has not been found in Arkansas, and probably the above species is the one observed and collected by Lesquereux and others reporting *E. hyemale* from this region.

Selaginella rupestris (L.) Spring, reported from Arkansas by Lesquereux appears not to have been collected, as no specimens are to be found in the herbaria consulted. Lesquereux (2) reports it as occurring on dry rocky sandstone. At the Mo. Botanical Garden, a specimen of *S. rupestris* was seen, found near Sapulpa, Oklahoma, (Bush No. 825) noted as "uncommon in moccasin tracks." The exact determination of this member of the *S. rupestris* group was not made. Its occurrence indicates that we may still expect to find this or some of the closely related forms of the *S. rupestris* alliance in Arkansas, but there seems to be no authentic Arkansas material in the herbaria.

Selaginella apus (L.) Spring, reported by Lesquereux, is found in North Arkansas. It was collected from near Batesville, Mammoth Spring, and Cotter (*E. J. Palmer*). It has also been found by the writer along

seepage planes on sandstone rocks under the bluffs of Cove Creek, Faulkner County.

Isoetes melanopoda Gay & Dur. found at Conway in wet meadows (*H. E. Wheeler*); has been taken from a number of similar stations near Fayettevills.

Isoetes Butleri Engelm. Wet Barrens near Eureka Springs, *Bush* 1530, N. Y. Bot. Gard. Herb., U. S. Nat. Herb., & Mo. Bot. Gard. Herb. Also on Fourche Mountain near Little Rock. Coll. by R. M. Harper and H. E. Wheeler. Fourche Mountain is an igneous intrusive formation composed of Pulaskite rock.

With the changes suggested here the lists of Arkansas ferns of the Geological Survey and those of the Filicales by Harvey are correct as far as we can determine allowing for mere differences of synonymy. This gives us 46 species and 3 varieties and forms in the corrected list of Arkansas Pteridophytes.

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1. Branner, John C. and F. V. Coville. A list of the plants of Arkansas. Annual Report. Geol. Survey of Arkansas for 1888, Vol. IV. Little Rock, 1891.
2. Lesquereux, Leo. Botanical and Palaeontological Report of the Geological State Survey of Arkansas. 2nd Report Geol. Reconnaissance Ark. (1859 & 1860. 295–399, pl. 1–6, Phila. 1860).
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4. Nuttall, Thos. Collections towards a flora of the territory of Arkansas. Trans. Am. Phil. Soc. (New series) 2: 139–203. Phila. 1837.
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6. Underwood, L. M. Our Native Ferns and their Allies. New York.

FAYETTEVILLE, ARKANSAS

Two Interesting Ferns from Arkansas

ERNEST J. PALMER

While collecting woody plants for the Arnold Arboretum, west of the Mississippi River, in the autumn of 1923, I spent several days in October on Magazine Mountain, in Logan County, Arkansas. This proved to be an extremely interesting locality both for its ligneous and herbaceous plants. Amongst a few of the latter class collected were two ferns, which I did not at once recognize (as familiar species for that part of the country). These turn out to be *Dennstaedtia punctilobula* (Michx.) Moore and *Woodsia scopulina* D. C. Eaton, both of which, so far as I know, have not been found before in the state nor in that region.

Magazine Mountain is an isolated flat-topped eminence, rising about 2000 feet above the surrounding valleys, and with its summit reaching a height of about 2800 feet above sea level. The formation is Pennsylvanian sandstone and shale. The mountain sides are steep, and the summit is bounded by a rim of precipitous bluffs in most places. On the north side these attain in places a perpendicular height of perhaps 200 feet or more, with remarkable accumulations of talus at their base. The top of the mountain is a level tableland, about seven miles in length and from a quarter to three quarters of a mile wide. Deciduous woods, with a small percentage of yellow pine (*Pinus echinata*), and with many small prairie openings, characterize the general region. The slopes of the mountain are heavily wooded, especially on the north side, where most of the rarer species occur. Oaks, hickories, sweet and black gum, red and sugar maple, linden, cucumber tree, buckeye, chinquapin and many other trees constitute the forest. The herbaceous growth shows much diversity at different levels, and

is remarkably rich in certain spots below the cliffs and on the fertile lower slopes. Amongst other northern plants noted were *Trillium recurvatum*, *T. viridescens*, *Sanguinaria canadensis*, *Actaea alba*, *Caulophyllum thalictroides* and *Viola pubescens*.

Woodsia scopulina was found growing in clefts and on ledges of sandstone, in partial shade, near the top of the mountain, and on the north side. The altitude of this point is about 2750 feet (825 meters). *Philadelphus pubescens* and *Ribes Cynosbati* were both abundant in close proximity. The fern was not rare locally, but was not noticed, nor specially sought for elsewhere on the mountain.

Dennstaedtia punctilobula was found in a very picturesque and romantic looking spot, locally known as "Fern Cave." Descending from the top by a devious and rugged trail, leading past a cold spring and through a narrow opening in the cliff, called the "Needle's Eye," our party, guided by a lady who lives upon and loves the mountain, found ourselves in a grotto, formed in a recess of the high overarching sandstone cliff. The top of the arch was perhaps 60 to 75 feet in height, and the distance at the base to the inner wall, measured from a plumb line let down from the top of the cliff may have been 50 feet. These figures are only approximations, as no measurements were taken. The cliff faces northward and receives oblique sunlight on part of its surface for but a few hours each day. There is considerable seepage water towards the floor of the grotto, and probably during wet seasons along bedding planes of the stratified sandstone. The fern was growing in great abundance in clefts and on small irregularities on the face of this arching wall, almost to the top. It was seen less abundantly on either side of the grotto, along ledges near the base of the perpendicular cliff, but not on the exposed portions above.

Owing to almost continuous rain during the three or four days I spent on the mountain, only a very inadequate exploration of this interesting locality was possible, and I am unable to say at present whether either of these ferns are more widely distributed there, but it is quite probable that they may be found elsewhere in similar situations. Other ferns noted on Magazine Mountain were *Botrychium virginianum*, *Polypodium polypodioides*, *Phegopteris hexagonoptera*, *Adiantum pedatum*, *Pteridium aquilinum* var. *pseudocaudatum*, *Cheilanthes lanosa*, *C. tomentosa*, *Asplenium platyneuron*, *Polystichum acrostichoides*, *Thelypteris marginalis*, *Cystopteris fragilis* and *Woodsia obtusa*.

The two species which are the subject of this sketch were collected under the following serial numbers: *Woodsia scopulina*, No. 24147, Oct. 15, 1923; *Dennstaedtia punctilobula*, No. 24125, Oct. 14, 1923. Duplicates of both may be found in the National Herbarium, Gray Herbarium, and the herbaria of the Missouri Botanical Garden and the University of Arkansas.

I am under obligations to Mr. Weatherby and Dr. Maxon for confirming determinations of these interesting ferns, and for information in regard to their range, and to Mr. B. F. Bush for records of *Dennstaedtia punctilobula* in Missouri, where it has been reported from Scotland, Madison and Ste. Genevieve Counties.

ARNOLD ARBORETUM

Equisetum Laevigatum and its Near Relatives[1]

JOHN H. SCHAFFNER

There is still considerable diversity of opinion among American botanists as to the identity and nature of

[1] Papers from the Department of Botany, The Ohio State University, No. 144.

Equisteum laevigatum A. Br. The writer has been considering the evidence for a correct determination of the case for many years: 1st. The actual nature of the plant described by Braun; 2nd. Braun's description. 3rd. The recognition of Braun's plant in the field. A number of years ago the writer[2] showed that Braun described, as *E. laevigatum*, a perennial plant with an apiculate cone and a green ampliated sheath; that the material sent to Braun by Engelmann was evidently of this nature; and that there was a somewhat similar annual plant without a pointed cone, which he described as *E. kansanum*, common in the central United States. This plant had usually been included with the true *E. laevigatum* in collections although no provision was made for it in the manuals. Braun's species had been correctly understood for years until Eaton called attention to the annual plant and transferred the name *E. laevigatum* to it. Braun stated that his species was nearest in its relationship to *E. hiemale* and *E. robustum*. Milde[3] in discussing *E. laevigatum* A. Br. insisted on this close relationship and also on its similarity to *E. debile* Roxb. He says, however, that the points of the cones are generally not so sharp as in *E. hiemale* and this is usually the case. There is, therefore, no question as to the nature of the plant Braun described.

E. laevigatum falls into the group of *Equiseta hiberna* and this group divides naturally into three sections. The first contains *E. ramosissimum* Desf., *E. debile* Roxb., and *E. laevigatum* A. Br.; the second section *E. praealtum* Raf. and *E. hiemale* L.; and the third section *E. variegatum* Schleich., with its varieties, and *E. scirpoides* Mx. The three species of the first section

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[2] Schaffner, John H. An undescribed Equisetum from Kansas. Ohio Nat. 13: 19-22. 1912.

[3] Milde, J. Monographia Equisetorum. pp. 546-554. 1865.

are characterized by ampliated green sheaths and more or less sporadic branching during the first season of growth of the aerial shoots. *E. ramosissimum* appears to be the most primitive of all the species of the group and forms the transition to the still more primitive horsetails of which *E. giganteum* L. and *E. myriochaetum* Schlecht. are examples. *E. myriochaetum*, although possessing abundant whorls of branches, has its stomata in single lines and in this respect agrees with the typical *Equiseta hiberna*. But in general it has the characters of the primitive horsetails.

E. debile is plainly intermediate between *E. ramosissimum* and *E. laevigatum* in respect to branching habit and is probably a direct offshoot from *E. ramosissimum*.

E. laevigatum is the most advanced species of the three from an evolutionary point of view. It is quite generally entirely unbranched, while such a condition seems to be rather rare in *E. ramosissimum*.

The three species differ little in fundamental characters but occupy distinct geographic regions. *E. ramosissimum* extends from Europe to Japan and south to southern Africa but apparently is replaced by *E. debile* in southeastern Asia and adjacent islands. *E. laevigatum* is apparently confined to North America. The reports of *E. ramosissimum* for western North America are probably all incorrect determinations based perhaps on profusely branched *E. laevigatum*. The scattered reports of *E. ramosissimum* from Central and South America may also be incorrect identifications based on depauperate, ecological forms of species like *E. myriochaetum* and *E. giganteum*; but the writer has no definite knowledge on this point.

As stated above, the annual North American form confused with *E. laevigatum* was described by the writer as *E. kansanum*. Eaton had previously described

a related form as *E. funstoni*. These two species constitute the writer's group of *Equiseta ambigua* and are without doubt an offshoot from near the base of the main branch of *Equiseta hiberna*, connecting closely with *E. ramosissimum* and *E. laevigatum*. They have retained several of the primitive characters of that group, as the long green ampliated sheath and the sporadic branching habit but have taken a decisive step forward of the same nature as the *Equiseta aestivalia* in that their cones have lost all or most of the vestigial point and their aerial stems have been reduced to the short-lived, annual habit.

The immediate ancestors of the horsetails must have been plants with perennial aerial shoots and the evolutionary progression is toward annuals as represented by *E. fluviatile* L. and *E. arvense* L. The point at the tip of the cone is a vestige of the primitive proliferating sporophyll-bearing shoot which disappears as the flower evolves.

It is evident, then, that *E. kansanum* and *E. funstoni* have progressed in the same direction as the higher horsetails and cannot conveniently be included with the *Equiseta hiberna* although there can be no question as to their close relationship. It is a matter of convenience in segregation and definition. *E. kansanum* is plainly the lower of the two species and *E. funstoni* may be regarded as a direct derivative from it, having acquired a peculiar branching habit, a slight change in the sheath and in the epidermal silex.

The line of relationship may, therefore, be indicated as follows: *E. xylochaetum*, *E. myriochaetum*—*E. ramosissimum*, *E. debile*, *E. laevigatum*—*E. kansanum*, *E. funstoni*. Of course, this does not mean that all these species originated from each other directly. We must keep in mind the phyletic view of relationship which is represented by an irregular branching system.

E. kansanum is apparently distributed within the geographic limits of *E. laevigatum* and this would give support to the view that it is a more recent derivative from that species. *E. laevigatum* apparently extends from British Columbia to Conn., south to N. Car., Mex., and Calif.; while the known range of *E. kansanum* is B. C. to Ohio, south to Mo., N. Mex., Ariz. and Calif. *E. funstoni* is apparently confined to Southern Calif. and Western Mex., having a distributional relation to *E. kansanum* somewhat similar to that of *E. debile* to *E. ramosissimum.*

Recently Munz and Johnston[4] in their treatment of the Equiseta of southern California have made a peculiar and from the writer's point of view an incorrect disposition of the Californian species. They say: "We are not at all satisfied as to the relationship of *E. funstoni* to *E. laevigatum.*" "*E. funstoni* is so close to *E. laevigatum* that we hesitate to recognize it as distinct from the eastern *laevigatum.*" But this is only perpetuating the old confusion; for there is a decided difference between *E. laevigatum* A. Br. and *E. funstoni* Eat., and Eaton evidently did not consider *E. funstoni* so very close to *E. kansanum* else he would not have described it as a new species. However, *E. kansanum* and *E. funstoni* are the closely related species and not *E. laevigatum* and *E. funstoni.*

Munz and Johnston further state that "in Schaffner's key" [which was not a key but a phyletic synopsis] "these species [*E. funstoni* and *E. laevigatum*] are widely separated by the division into groups according to whether or not the cone is tipped by a rigid point, but the difference between the species is not as great

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[4] Munz, Philip A. and Johnston, Ivan M. The Distribution of Southern California Pteridophytes—Equisetaceae. Am. Fern Jour. **13**: 4–7. 1923.

as the division might suggest. for many plants are intermediate in this development.'' However. a still more fundamental difference was given in that the one group is stated to have perennial, aerial shoots and the other annual. It is true that there is decided fluctuation in this vestigial point even in species where it is prominently developed as in *E. hiemale*. But it has, nevertheless, been used for a very long time, and rightly so, as an important diagnostic character. As to the degree of relationship indicated in the synopsis the authors apparently did not interpret the scheme of the phyletic arrangement properly. It plainly shows the two species at the bases of the two branches, so if the two branches are related the two species necessarily come close together. The scheme presented in the paper[5] simply follows out the old notion that the evolutionary relationship can be represented most appropriately by the branching system of a tree, the supposedly most primitive member of any branch being placed at the bottom and the most recent member at the top.

COLUMBUS, OHIO

The Rootstocks of the Spinulose Ferns

EDWARD H. CLARKSON

During the construction of a fern garden, having occasion to transplant many of our New England ferns, the writer was impressed by the fact that, while the rootstocks of the various kinds often differed greatly from each other, those of each species were noticeably alike both in structure and in habit of growth.

In the case of the spinulose ferns, *Dryopteris spinulosa* (Muell.) Kuntze, *D. dilatata*, var. *americana* (Fischer) Benedict, and *D. intermedia* (Willd.) A. Gray,

[5] Schaffner, John H. North American Species of Equisetum North of Mexico. Am. Fern Jour. 11: 65–75. 1921.

the very interesting discovery was made that the last mentioned of the three appeared to have an erect or decidedly ascending rootstock, whereas the rootstocks of the other two were decumbent.

Our fern books have very little to say regarding the underground parts of these particular ferns. In "Ferns of North America," published in 1880, D. C. Eaton, who considered the three to be varieties of a single species, described their rootstocks as "either creeping, or assurgent, or even occasionally erect," but gave no further particulars. There seems no reason to infer, from this general description, that Professor Eaton meant to describe the rootstocks of any *one* of the three spinulose ferns as being sometimes creeping, and at other times assurgent or erect. In "How Ferns Grow," published in 1906, Margaret Slosson described the rootstock of *Dryopteris spinulosa intermedia* as "creeping," with the "leaves clustered slightly back of, or partly encircling, terminal leaf-buds," which certainly does not agree with the observations of the writer.

In order to be absolutely certain that the differences in the habit of growth, as noted above, were not due to some peculiar conditions existing in the fern garden, a careful inspection of these ferns as they grew in the wild appeared necessary. In the vicinity of Newburyport, *Dryopteris spinulosa* and *D. intermedia* are to be found in abundance. An examination, during the summer and autumn of 1923, of a large number of these ferns in the woodlands of Newburyport, Newbury, Salisbury, and Merrimac, Massachusetts, has shown the following results.

The rootstocks of typical *intermedia* were found to be ascending and very frequently erect, and the leaf-buds, which in late autumn are large and fully developed, were arranged in compact clusters, each cluster surrounded by

a circle of fronds, much like *Dryopteris marginalis* (L.) A. Gray. Occasionally there would be found an *intermedia* plant with a somewhat decumbent rootstock, just as *marginalis* is sometimes found. In both cases, the washing away of the soil by running water, the action of frost, or the deflection caused by a rock, tree-root, etc., would easily account for the apparent exceptions.

The rootstocks of *spinulosa* were found to be uniformly decumbent.

In the fern garden are about thirty roots of our eastern North American form of the broad leaf spinulose fern, *Dryopteris dilatata*, var. *americana*, a number of which the writer collected in the White Mountains of New Hampshire. They have been growing in their present situation for from three to seven years, and are vigorous, healthy plants, having been given, as nearly as possible, the soil conditions of their native woods. The rootstocks of these thirty ferns, which apparently do not burrow quite so deeply in the soil as do those of *spinulosa*, are without exception decumbent, and most of the fronds are clustered just back of the terminal leaf-buds, which they sometimes partly encircle. In late autumn the leaf-buds, tightly coiled and covered with a thick layer of coarse brown scales, may be seen protruding just above the soil. Because these buds grow out from the rootstock at a slightly oblique angle, one or more of the fronds will sometimes spring out from the under side of the bud clusters, and occasionally a few of these fronds will form an irregular circle around these coiled buds. By far the greater number of the fronds, however, appear to be always back of the bud clusters.

The leaf-buds of *spinulosa* are generally much more loosely arranged, and in late autumn are usually partly unrolled so that half an inch or more of the stem is

often exposed to view. Most of the fronds are clustered slightly back of these terminal leaf-buds, which they sometimes partly encircle. The rootstock of *spinulosa* appears to plow through the soil at a somewhat greater depth than is the case with *dilatata*, var. *americana*, and it would seem reasonable to assume that if its leaf buds remained tightly coiled they would be in danger of being harmed by moisture or frost. By unrolling somewhat, the delicate coiled tops of the crosiers are raised sufficiently above the surface of the ground so that they go safely through the winter season.

The scales on the leaf-buds of *spinulosa* are smaller and fewer than are those of *dilatata*, var. *americana*, and they lie smoothly on the surface, so that the outline of the crosiers and the bright olive-green color of the short stems may be clearly seen.

Plates 3 and 4, made from photographs of half-sections of the rootstocks of the three spinulose ferns, show the habit of growth, the leaf buds, and the arrangement of the fronds, very nicely. A condensed summary of the rootstock characters of these three ferns, as seen in autumn, follows:

Rootstocks erect, or ascending; fronds surrounding the compact clusters of leaf-buds ..... *intermedia*

Rootstocks horizontal or decumbent; most of the fronds clustered just back of the terminal leaf-buds, which they sometimes partly encircle.

Leaf-buds usually loosely coiled, thinly covered with appressed scales ..... *spinulosa*

Leaf-buds usually tightly coiled, thickly covered with spreading scales ..... *dilatata*, var. *americana*

The results of this investigation are published for the purpose of calling attention to what are apparently important differences between these ferns that appear to have escaped general attention, and to invite further

investigation. It is of course, possible that conditions of soil, moisture, altitude, etc., may affect the rootstock habits differently in other sections of North America, and that these characters, as found to exist in the Newburyport district, may not hold everywhere. However, the evidence seems practically all the other way—so far, at least. Dr. Ralph C. Benedict, who for many years has made a special study of the spinulose fern group, writes me as follows: "Your observations about the habit of growth of *intermedia* agree with my own, as based on observations in several parts of New York State—Adirondacks, central New York, and the region around New York City, Connecticut and New Jersey included."

Although typical specimens of the three spinulose ferns differ so distinctly that they are easily recognized, there are intermediate forms so nearly approaching each other in appearance that even our most expert fern students are occasionally puzzled to decide how they should be classified. Should the differences in the rootstock habits, as pointed out in this article, prove dependable, it seems probable that *Dryopteris intermedia* would be generally recognized as a separate species, and the task of identifying the intermediate forms should be made much easier.

NEWBURYPORT, MASS.

Ferns—Facts and Fancies About Them[1]—I.

F. E. CORNE

How is it that in an age of nature-study ferns for themselves attract so comparatively little attention? Many love them as attractive plants and often even grow fine specimens in house or garden—but is this not usually

[1] Prepared for, and read to the Cambridge Plant Club and the Scituate Garden Club, Massachusetts.

Sections of Rootstocks of Dryopteris intermedia, showing their ascending or upright Habit

Sections of Rootstocks of Dryopteris dilatata, var. americana (left) and D. spinulosa (right), showing their prostrate Habit

more by good luck than the result of any real knowledge of the fern's needs? I have seen more than one fine plant, brought as a treasure hundreds of miles from its mountain home, killed outright because the recipient, wise in the ways of ordinary garden plants, insisted on planting it as one might a peony or a potato, covering its crown and smothering the life out.

In England it is different. There, as long ago as 1877, the author and fern-lover, Francis George Heath, could write: "Fern culture in our houses and in our gardens is not merely a popular pursuit, it has become a popular passion." This statement would not be true in America even today.

Possibly the schools have been somewhat to blame. In my own time, but scant attention was paid to ferns. We were taught, of course, that they were cryptogams, and cryptogams flowerless plants; and we were required to bring a few fronds to the class just to prove that we knew what a fern looked like. I can remember even now, though it is long ago, how I just laid the required specimen on the teacher's desk, then turned eagerly to analyze some favorite flower. I heard no more about the ferns. That scientific botanists knew mysterious things about them I became, of course, aware, but that there could be anything of especial interest to me personally and that this I could learn even without a teacher, never occurred to me. I had only the vaguest ideas as to the differences between ferns and flowering plants, and later having heard of "true ferns" and "fern allies," imagined that coarse plants like the brake, so different from the few delicate ferns that I knew, must belong to the allies, and was much puzzled about the so-called "sweet fern" and "asparagus fern."

This ignorance on my part is a matter of deep regret to me now because during the many years I spent abroad

I had unusual opportunities to make a fine collection of European specimens. As it was, I conscientiously restrained my natural instinct to collect and gathered only a few which struck me as very unusual, or as souvenirs of some interesting or historic places. These few have become treasures. For instance, I have a tiny Venus-hair which I found at St. Cloud, near Paris, smaller and more delicate even than our hot-house *cuneatum*. A very large black spleenwort (*Asplenium Adiantum-nigrum*) came from the St. Gotthard Pass. I have also an unusually large moonwort from the same region which I gathered for its oddity, not having the slightest idea what kind of plant it might be. A tiny maiden-hair spleenwort, scarcely an inch and a half high yet completely covered with sporangia, came from a spray-dashed rock in a beautiful gorge near Faido in the Ticino Valley, Italian Switzerland. The scaly spleenwort, or ceterach, I found growing in quantities on the walls of the old town of Gandria on Lake Lugano. This little plant had deeply scalloped fronds of a dark bluish green bordered with a thread of silver and on the under side so densely covered with scales that they appeared to have a brown velvet lining. A quaint, pretty little fern—I found it again on the walls of the Alhambra. *Pteris cretica* also grew on the old stone walls of Gandria, but I have no specimen of it.

Then the hart's-tongue. My first encounter with it was when tramping with some English friends in the Austrian Tyrol. We were on our way to visit the great salt mines at Hallein and were passing over a partly shaded hillside when a young girl of the party suddenly darted forward with a joyous shout, as if unexpectedly meeting an old and dear friend. "Why, *here* is the hart's-tongue fern!" I saw a number of odd-looking plants about a foot high with glossy, strap-shaped leaves

—very pretty, but why did she call it a fern, I wondered. It was quite unlike any fern that I had ever seen to my knowledge. I got a little plant of it and immediately tried to brush off the rows of sporangia on the back of a leaf, thinking them the trace of some insect, until something in the tenacity with which the raised brown lines clung to the leaf and the regular manner in which they were placed, made me vaguely wonder if they might not perhaps be some integral part of the leaf itself. But what that might be I could not guess, and it was long before I found out.

I met with the hart's-tongue in that same region a few years later when I was spending the summer at Berchtesgaden. The quaint old house in which I was boarding had once been a convent and my little white-washed room the cell of a nun. Among the guests in the house were several who, like myself, were very fond of walking and we often made up parties and went off together. So, hearing that a beautiful uninterrupted view of Salzburg could be had from the side of a mountain some five or six miles away, we started off one fine morning, just after the usual simple breakfast of coffee, rolls, and butter, to go there, expecting to be back for the early afternoon dinner.

I can still remember how loquacious an old English gentleman of the party was—at first—boasting of some long tramps he had recently taken and how "fit" he was. I can see the little white house dog, too, jumping about, barking, and wagging his beautiful bushy tail until it seemed as if it must wag off, in his delighted excitement at being allowed to accompany us. On the way we passed through a gloomy but very beautiful wood. A narrow plank walk ran all the way through it, so it was probably very damp, and it was full of most interesting looking plants. But my companions,

bent only on reaching their destination, looked neither to right nor left, so I would not ask them to stop, hoping for more leisure on our return trip. Suddenly, close by the walk, I saw a magnificent plant of hart's-tongue fern. This time I recognized it at once, though it was very much larger and finer than those I had seen a few years before. I tried hastily to gather one of the fronds, which was between two and three feet long and two or more inches wide, when the whole plant came up out of the rich, moist earth. Not wanting to throw it away and having no other place to carry it, I wrapped the roots in my handkerchief and fastened it to my belt, afterwards giving it to my hostess, who was fond of plants.

That beautiful gloomy wood I was destined never to see again, for, after enjoying the view from the mountain-side, we inadvertently took a wrong path and reached the road on the other side of the mountain, many miles out of our way. Night had fallen and we had long been stumbling along in pitch darkness before the lights of Berchtesgaden appeared in the distance. For hours the loquacious old Englishman and the lively little dog had trudged on in absolute silence, as well they might, for we had tramped twenty-five miles before we reached our Pension. Notwithstanding the scant fare that day—a slice of black bread and a cup of atrocious coffee bought at a tiny wayside inn—I had not felt hungry, but I have never forgotten how delicious the broiled chicken tasted which was served us for supper.

A small, very delicate form of the hart's-tongue I later met with frequently in Italy, usually growing out of reach among the stones on the under sides of old Roman arches. The species is not uncommon on the continent of Europe and in England there are a great number of varieties—some with beautifully ruffled edges.

others with young plants growing out of the upper side of the leaves, and others so divided and subdivided that they have lost entirely the strap-like frond typical of the normal plant. I have had two plants of hart's-tongue in my fern bed, one sent me from England, the other from an American dealer, but conditions are evidently not right, for neither of them lived more than a season or two.

A few years ago I became the happy possessor of Mrs. Parson's "How to Know the Ferns"—which I at that time innocently supposed contained all the fern lore that I should ever need or care for—and a new world of pleasure was opened up to me. I spent that summer in New Hampshire, and with no other help became quite familiar with twenty-one species—all, I believe, that are attributed to that region.

Here a little advice to the beginner may not be out of place. One person said to me recently: "The study of ferns is beyond me, I know; I could never even remember all those technical names." To those who have studied Greek and Latin, "Latin names, with Greek derivation and American pronunciation" ought not to be difficult to remember. But, if they are, do not try—at least not at first. Almost all of our ferns have local English names, and after all, the name is not the important thing. One must first of all be able to tell with certainty when a plant is a fern and not a fern-like flowering plant, and then, if possible, to find its proper genus. Later when exchanging specimens, those technical names will be necessary, but by that time you will probably have learned many of them without effort. It will be necessary to know them, because many of the English names, being local, would be misleading to persons living elsewhere. For instance, the lace fern of the eastern States is not the same as the lace fern of the West. The English

hay-scented fren, "*Lastrea recurva*," is quite a different species from our hay-scented fern, and ours is also in some places called boulder fern, gossamer fern and so on. But, for a beginning, the English names do very well.

Don't be alarmed at the fancied depth of the study. The old adage that "a little knowledge is a dangerous thing" does not hold good here. Just a little accurate knowledge will add greatly to the pleasure and interest of every trip to the country—especially, of course, to the deep woods where the greater number of ferns are to be found. But on the highways and byways one also meets with a few. And, as some one has said, "even a bowing acquaintance with them is a pleasant thing."

CAMBRIDGE, MASS.

DICHOTOMOUS BRANCHING IN EQUISETUM.—Dichotomous branching or twinning of the terminal bud is the normal process in the Lycopods and their allies, while monopodial branching is characteristic of all other, living vascular plants. However, dichotomy may appear sporadically as an abnormality in almost any of the groups of higher plants. It is especially common in the genus Vernonia. In recent years examples of dichotomous branching have been looked for by the writer in his rambles among our native species of Equisetum. So far only a very few examples have been found, all of the species, *E. praeultum* Raf. All these shoots were sterile and otherwise unbranched. Two are here described to show the general nature of the twinning. The shoots were of normal height and number of internodes. One of these shoots began to show signs of twinning in the third internode below the tip. The second internode is short and shows a prominent groove on each side. The last internode is very short and the

"twins" are completely separated. The other shoot had a longer period of growth after twinning began. The ninth internode from the tip of the longer branch shows a slight flattening at its upper end, the next internode is normal in length but grooved on the two sides. The third internode is one half the normal length and has two deep grooves on opposite sides. Then the "twins" are separate both having a very short internode at the base. The one branch continues with four internodes of normal length to the tip and the other with three normal internodes. There is, therefore, a decided difference in size and character between the two branches, probably due to the fact that the twinning bud did not divide into two exactly equal parts originally rather than the other possibility that one branch grew at the expense of its twin brother. Some day, perhaps, we may learn to produce such abnormal developments at will.

John H. Schaffner.

A Fern Lover's Garden.—By invitation of Mrs. Frank E. Lowe, a member of the American Fern Society, we visited her fern garden at North Worcester, Mass., on the 21st of June. Here we saw more than forty species of ferns many of them quite rare. The fernery is located about four miles north of the city on an elevation with a southward slope and overlooking Indian Lake, thus commanding a beautiful view of the lake and of the northern suburbs of the hub city of the state. At the family homestead, where our hostess had spent her childhood and youth as well as her maturer years, we received a cordial welcome and felt the attraction of the wonderfully picturesque environment.

Mrs. Lowe has collected for her fern garden most of the ferns of Worcester County, besides introducing rare species from outside. Our walk among her ferns and

under her guidance was highly rewarding. Lingering frequently in admiration of their beauty, we spoke of their characteristic features, using freely the common English names or the equally familiar Latin as seemed in each case most agreeable.

It was obvious that great pains had been taken to select the most fitting soil, largely fine peat and leaf mold which with careful cultivation insured a vigorous and wholesome growth.

The three stately Osmundas lifted their handsome fronds in conspicuous beauty as if in pride of their divine birthright, awakening our instant admiration. The two bladder ferns fixed our attention by their extremely delicate and attractive fronds, the long slender blades of the bulbous species reminding us of their habitat by cool springs and rippling streamlets. Here too was the Rusty Woodsia with its thick stubble suggesting the jointed stipes of the genus, and the Obtuse Woodsia with its beautiful, star-like indusia. Before us was growing the plain Sensitive Fern waiting to welcome a little later its fertile fronds curiously clenching in their fist-like sacks the numerous sporangia. Near by the Ostrich Fern, stately and aggressive, waved its feathery plumes unsurpassed for grace and dignity. Next a mass of Dicksonia claims our attention. Although science now gives its generic name as Demstaedtia, it does not forbid us to use the well-beloved name, Dicksonia, in speaking of the hay-scented or boulder fern, or more poetically "the fine-haired mountain fern." How unique its pretty green fruit dots each lifted on a recurved toothlet,—a little globose cup filled with sporangia and open at the top! Not less charming the lovely Maidenhair now greets us with its mass of delicate fronds and conspicuous, glossy stipes,—a sample of the many similar colonies which adorn this fern-abounding region. Just

yorder is the rival climbing fern, the beautiful *Lygodium palmatum*, our only twiner, and the most superbly decorative of them all. We found Mrs. Lowe's little clumps growing luxuriantly and supplying her friends with coveted specimens.

Next comes the Rattlesnake Fern, and the two common Grape species so unique in structure and growing finely. Her little Rue Spleenwort after a trying winter had put forth new fronds and seems to have gained a permament foothold. Nearly all her spleenworts are doing remarkably well. The Lady Fern is aggressive as usual; the Narrow-leaved and Silvery species are flourishing and handsome; so of the Ebony and Maidenhair. Here also may be seen the Walking Fern, but struggling onward with difficulty; also the captivating Braun's Holly Fern and its near relative the Christmas Fern,—which is the coveted "dagger fern" of the trade. Her eleven Wood Ferns are all vigorous and constitute an interesting sisterhood. They are the Marsh, Massachusetts, New York, Marginal Shield, Goldie's, Bootts's. Crested, Clinton's Crested, Spinulose, Spinulose-intermedium, and Spinulose-americanum (or dilatatum). Intermedium is the "fancy fern" of the trade of which millions are sold for decoration. All these Wood Ferns except perhaps americanum are native to this locality, and the Massachusetts is very common here.

In addition to these may be seen the Common and the Net-veined Chain Ferns, the Common Polypody with its companions., the three Beech Ferns, and the large ubiquitous Bracken.

It was indeed a privilege highly to be prized to visit this combination fern colony guided by its enthusiastic owner and maker, whose love of nature sheds its charm over this miniature paradise.—GEORGE H. TILTON.

NOTE ON THE FORMS OF POLYPODIUM VIRGINIANUM.—The forms of the polypody of eastern North America, so far as they are known, fall into two series, in one of which the tips of the division of the frond are obtuse, in the other acute or acuminate. This grouping is summarized in the following table, suggested by Dr. Edgar T. Wherry.

FORM OF FROND	TIPS OBTUSE	TIPS ACUTE
Not pinnatifid	f. *subsimplex*	——
Pinnatifid below, with elongate simple tip	f. *elongatum*	——
Simply pinnatifid	f. *brachypteron*; typical form	f. *acuminatum*
More or less bipinnatifid	f. *bipinnatifidum*	f. *cambricoides*
Same, with lower pinnae auricled	f. *deltoideum*	——
Same, and crested	f. *chondroides*	f. *alato-multifidum*

F. *Churchiae*, of which no specimens have been seen by the writer, could not be placed from the description.[1]

Since the very striking f. *cambricoides*, recently described by Mr. F. W. Gray, was known to him only from West Virginia, the following specimens, lately received at the Gray Herbarium from the collection of George E. Davenport, may be cited as showing the range of the form: Holderness, N. H., *Mrs. Webster*, 1901; Cornwall, Conn., *L. M. Underwood*, Sept., 1890 (basis of the report of *Polypodium vulgare*, var. *cambricum* from Connecticut in State Nat. Hist. & Geol. Surv. Bull. **14**: 17. 1910); Dark Bay, Lake George, N. Y., *Geo. D. Hulst*,

[1] For these forms, see F. W. Gray, Am. Fern Journ. **14**: 3–7. 1924; M. L. Fernald, Rhodora **24**: 125–142, 1922.

May 30, 1897, (basis of report of *P. vulgare*, var. *cambricum* in AM. FERN JOURN. **7**: 57, 1917). The plant illustrated on page 83 of Waters's *Ferns* and said by him to have been collected in the Catskill Mts., N. Y., by Miss Mary F. Miller, also belongs here.

In none of these specimens is the development of the lobes so extreme as in the beautiful fronds gathered and illustrated by Mr. Gray. But, however short, they are always narrow and pointed. Lobes of the same length in f. *bipinnatifidum* are proportionally broad and very blunt. The distinction between the two forms lies, then, not in the degree of cutting, but in the difference in the form of the segments. F. *cambricoides* may be plausibly regarded as a derivative of f. *acuminatum*, f. *bipinnatifidum* as a derivative of the typical form of the species.

Nomenclatorially, f. *bipinnatifidum* is the same as *Polypodium vulgare*, var. *sinuatum* of American authors, in so far as this name was applied to the east American plant. F. *cambricoides* includes *P. vulgare*, vars *cambricum* and *semilacerum* of American authors, as to the east-American plant. These varietal names were all founded on forms of the European polypody [the original *P. vulgare*] and cannot now be properly applied to the plant of eastern America [*P. virginianum*], which Professor Fernald has shown to be different from the European.—C. A. W.

The constitution of the Fern Society provides that any three members in good standing may, if they wish, make independent nominations for officers. Any such nominations sent to the Chairman of the Nominating Committee, Mr. Robert A. Ware, 246 Devonshire St., Boston, Mass., before Aug. 20, will be placed on the official ballot

American Fern Society

Through the generosity of Mr. F. G. Floyd and the interest of the late Miss Mary A. Day, Librarian of the Gray Herbarium, there has been gathered at that institution a considerable set of documents relating to the American Fern Society. Some of them are not in the Society's own collection. Taken together with the earlier volumes of the *Fern Bulletin*, the Gray Herbarium set gives a fairly good epitome of the Society's history; the following condensed list of what it contains should be of interest to our members.

Typewritten constitution and list of members, Linnaean Fern Chapter, undated.

Undated list of members, 27 in all.

Lists of members, 1896, 1898, 1913, 1915–1918, 1920.

Reports of officers, 1896–1912.

Constitution, 1899, 1905, 1910, 1914; circular of committee on revision, 1911.

Catalogue of herbarium, 1909.

Election notices and ballots, 1905–1922 (1907 missing).

Specimen bill-head and notice to delinquent members.

Notices of field meetings; Amherst, Mass., 1909; Still River, Mass., 1910; Newfane, Vt., 1916.

Notices and programs of other meetings: Boston, 1898, 1909, 1917, 1922; New York, 1900; St. Louis, 1903; Philadelphia, 1915.

Manuscript of G. E. Davenport's address at Boston meeting, 1898; newspaper account of this meeting.

Circulars and letters in regard to the election of 1910 and the establishment of the JOURNAL.

Eight advertising circulars of various dates.

Judge Charles Francis Jenney, a member of the Society since 1901, died at Boston, Nov. 29, 1923. Judge Jenney was born at Middleboro, Mass., Sept. 16, 1860, the ninth in descent from John Jenney, who settled at Plymouth in 1623. He graduated from the Law School of Boston University in 1883. Much of his early professional work was concerned with land titles; he studied

and passed upon the titles of hundreds of parcels of real estate acquired for the Metropolitan Park System. In 1886 he was elected to the Massachusetts legislature. In 1909 he was appointed to the Superior Court and in 1919 to the Supreme Court of Massachusetts. For twenty years he was a lecturer on law in Boston University.

Judge Jenney was a man of "kindly and human" character, traits which often appeared in his treatment of cases brought before him, though never to the detriment of a properly strict interpretation of the law. Outside his profession, he possessed a wide culture. As befitted a descendant of the Puritans, he was interested in the local history of eastern Massachusetts, and published two monographs on subjects connected with it. Botany and zoology were other active interests, which filled many of his vacations.

Joseph Jackson, a member of the Society since 1898, died at Leicester, Mass., Jan. 9, 1924. He was born in England, Nov. 6, 1847. His family came to Rhode Island early in 1848; he was educated in the Lonsdale schools and at Brown University, from which he graduated in the class of 1868. The same year he began his life work as a teacher, going to Derby, Vt., as principal of the academy there. He continued in his chosen work without interruption for forty-eight years, till 1916, when he asked to be retired because of ill health.

While principal of the high school in Millbury, Mass., he became interested in wild flowers, and followed closely the flowers and trees through the different seasons. He began to write articles on nature for the *Worcester Spy* and these articles attracted much attention. In 1894 they were gathered together and published, with illustrations, in book form, under the title "Through Glade and Mead." The edition was limited and quickly sold.

In 1883 Mr. Jackson wrote a Flora of Worcester County, the first book of its kind for that region. In 1894 a second edition of it was printed and in 1909 a third edition, revised, enlarged, and beautifully illustrated, was brought out. A fourth edition is in manuscript.

Mr. Jackson was a classical scholar and his library is filled with the best literature. He was keenly interested in all the botanical journals and was always on the watch for a new plant in his home neighborhood. He was a wonderful teacher, always ready to impart his knowledge to the profit and pleasure of his hundreds of pupils.—ALICE M. JACKSON.

Report of the Treasurer for 1923

RECEIVED

On hand Jan. 1st.			$ 384.91
Membership dues 1921	$ 1.50		
1922	28.00		
1923	360.00		
1924	33.50		
in advance	4.50		
Total dues received	$ 427.50	$ 427.50	
Subscriptions to JOURNAL		73.15	
Miscellaneous receipts:			
Advertising	$ 4.00		
Collection fees	.50		
Interest	26.60		
Collection, old account	11.07		
	$ 36.17	36.17	
Gifts to Illustrating Fund		10.04	
Gifts to Reprint Fund		4.00	
Sales back numbers, to Emergency Fund		82.67	
Total receipts in 1923	$ 633.53	633.53	
GRAND TOTAL			$ 1,018.44

Brought forward			$1,018.44
PAID OUT			
Treasurer's expenses		$ 14.65	
Secretary's expenses		23.24	
JOURNAL expenses,			
Budget and extra appropriation	$ 420.45		
Illustrating Fund	4.54		
Total cost of JOURNAL	$ 424.99	424.99	
Curator's expenses		24.39	
Special Reprint Fund		15.06	
Council Order No. 46:			
Books to Library in settlement of old account		6.07	
Curator, extra expenses		5.00	
Council Order No. 47:			
Reprinting Vol. 1, No. 3, 200 copies		53.00	
Suspense account: uncollected check, maker of which died		1.50	
GRAND TOTAL	$ 567.90	567.90	
Balance Forward		$ 450.54	

This balance is made up as follows:

EMERGENCY FUND		
On hand, Jan. 1st, 1923	$ 64.21	
Received	82.67	
	$ 146.88	146.88
ILLUSTRATING FUND		
On hand, Jan. 1st, 1923	$ 12.93	
Received	10.04	
	$ 22.97	
Paid out	4.54	
On hand, Dec. 31st, 1923	$ 18.43	18.43
Carried forward		$ 165.31

Brought forward		$ 165.31

SPECIAL REPRINT FUND

On hand, Jan. 1st, 1923, of appropriation	$ 24.13	
Gifts received	4.00	
	$ 28.13	
Paid out	15.06	
On hand, Dec. 31st, 1923	$ 13.07	13.07
SPECIAL ORDER FOR CATALOGUING THE HERBARIUM		$ 25.00
GENERAL FUND, FROM DUES, SUBSCRIPTIONS, ETC.		247.16
		$ 450.54

THE SPECIAL PERMANENT FUND now stands as follows:

On hand, Jan. 1st, 1923	$ 382.51	
Life membership received	25.00	
Interest received	15.65	
Total	$ 423.16	
Brought forward		$178.38

There are no unpaid bills.

The treasurer suggests that we again transfer $100 from the Emergency Fund to the Special Permanent Fund, bringing this at last to the goal we set, $500, and a little over. I further suggest that from Jan. 1, 1924, we use the interest received from this Permanent Fund for illustrations or extra pages in the Journal. If these suggestions meet with the approval of the officers, Council orders to put them into effect will be prepared by me.

I wish to thank the members for their kindness and assistance to me in the conduct of this office.

Respectfully submitted,

J. G. UNDERWOOD, *Treasurer.*

For the two illustrations in this number, the JOURNAL is greatly indebted to Mr. Edward H. Clarkson. He has not only furnished the plates, but has met the extra cost of running them as a double-page insert.

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Torreya. Bi-monthly, established 1901. Price, $1.00 a year. Manuscripts intended for publication in TORREYA should be addressed to GEORGE T. HASTINGS, Editor, Robbins Place, Yonkers, N. Y.

Memoirs. Occasional, established 1889. Price, $3.00 a volume.

Preliminary Catalogue of Anthophyta and Pteridophyta within 100 miles of New York City, 1888. Price, $1.00.

Subscriptions and other business communications should be addressed to the Treasurer, MISS MARY L. MANN, 59 East 86 St., New York City.

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American Fern Journal

A QUARTERLY DEVOTED TO FERNS

Published by the

AMERICAN FERN SOCIETY

EDITORS

R. C. BENEDICT

E. J. WINSLOW C. A. WEATHERBY

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A FROND OF DRYOPTERIS DILATATA, VAR. AMERICANA FROM BYFIELD, MASS.

American Fern Journal

Vol. 14 JULY–SEPTEMBER, 1924 No. 3

Dryopteris dilatata, var. americana in eastern Massachusetts

Edward H. Clarkson

On October 2nd, 1923, the writer found, in what appeared to be an old peat bed, in a moist woodland at Byfield, Massachusetts, eight plants of the broad-leaf spinulose fern, *Dryopteris dilatata*, var. *americana* (Fischer) Benedict. These plants formed three clumps that were several yards distant from each other, and grew in the shade of good-sized white pine and deciduous trees. Scattered about were quantities of typical *Dryopteris intermedia* (Willd.) Gray, growing luxuriantly.

Two in particular of the *americana* roots were fine old plants and their decumbent rootstocks, covered thickly with coarse, imbricated stalk-bases, could be traced along the ground for seven and eight inches respectively. This fern is not an evergreen, and many of the fronds had already succumbed to the early light frosts and were curled and browned. Most of the remaining fronds were much faded, some being bleached nearly white. A few, however, were sufficiently well preserved to still make fairly good herbarium specimens.

The only other known case, so far as the writer is aware, of this fern having been found at sea-level in New England (outside of a cold and often foggy area in south-

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eastern Maine) was at Brockton, Massachusetts, in August, 1907, by Alvah A. Eaton. Fronds from his plants may be seen at the Gray Herbarium, Cambridge.

A careful examination of the Byfield "*americana*" fronds, under the high-powered botanical dissecting microscope at the Gray Herbarium, revealed the further interesting fact that more or less of the indusia of all excepting one of the fronds were sparsely glandular. Mr. C. A. Weatherby very kindly examined 106 *americana* specimens in the Gray Herbarium collection, ranging from Greenland to North Carolina, and reported as follows: "Perhaps a sixth of them—I did not keep accurate account—were sterile and can be disregarded. Of the others, just three, that were otherwise good *americana*, showed sparsely glandular indusia, about as much as your Byfield plants. Two of these were from Nova Scotia, and one from the mountains of Virginia."

So far as the writer can learn, this is the first time that the finding of *Dryopteris dilatata*, var. *americana* with glandular indusia has been definitely recorded.

The discovery of this fern at sea-level in eastern Massachusetts is a matter of considerable interest, inasmuch as its usual habitat, in this latitude, is in the higher mountain regions. Fern spores are very minute particles and will undoubtedly travel long distances with the brisk breezes, and some of them are apt to fall where conditions of soil, moisture, and temperature are favorable for their germination and growth. The writer feels certain that there are more or less *americana* plants scattered about throughout central and southern New England, and would urge fern enthusiasts to make a special effort to discover some of these. Plate 5 shows one of the Byfield fronds. Get the shape of this frond in your eye, and do not be discouraged if you do not find its like at once. It will help in looking for it to remember that

americana has a prostrate rootstock, whereas *intermedia*, as a rule, grows like *marginalis*, the rootstock being upright or strongly ascending, with the fronds arranged in a circle around the compact cluster of leaf-buds.

Please send any information regarding finding var. *americana*, with specimen fronds, to the editors of the AMERICAN FERN JOURNAL. It is to be hoped that if any reader is so fortunate as to discover this fern growing near sea-level in New England, such plants may be allowed to remain undisturbed for future observation.

NEWBURYPORT, MASSACHUSETTS

Problems in the Study of the Spinulose Ferns

RALPH C. BENEDICT

The classification of the spinulose dryopterids has been a matter of particular interest to me ever since I began the study of ferns as a boy, twenty-five years ago. Mrs. Parsons's "How to know the ferns" was my introduction. I enjoyed reading her stories of the different species, and as my home was in Onondaga county, New York, there was special inducement to field trips to look for the rarities which central New York harbors.

Some of these rarities and more unusual forms were found rather easily and early. Some of the commoner sorts remained undiscovered. Later experience has shown that a widely distributed and abundant species may be locally absent from considerable areas within the confines of its range. It was my experience to read about such common sorts as the fragile bladder fern, and the rusty and obtuse woodsias, and then to hunt unavailingly about Syracuse. I never found the woodsias in Onondaga County, although I have since understood that there is one locality for them in the southeastern part of the county.

The spinulose types furnished another complication. As I read in Mrs. Parsons's book, I got the impression that I might expect to pick up any one of the three "varieties" in any woods. Accordingly I examined scores of *intermedia* plants. Every one with broader leaves was suspected of being *dilatata*. The first typical *spinulosa* I found was a strict-leaved form, so different from *intermedia* that it was tentatively called *Boottii*, which I had not then found.

Enlightenment came with a chance to see *spinulosa* as it occurs commonly near the coast around New York City. Dr. Philip Dowell pointed out what has since seemed to me the proper solution of the field and herbarium classification of these three forms, *viz.*, that they are three valid species, differing consistently in leaf characters, and differing further in preferring separate habitats, although their requirements in this respect are not mutually exclusive. Mr. Clarkson's studies are important as showing also differences in rootstock characters.

It will be worth while here to set down a few points as a basis for further discussion and study. At present there is apparent disagreement not merely whether these forms are "species" or "varieties," but more fundamentally, as to the facts upon which opinions must be based. My own judgment, that they are three taxonomic species, is founded on the following points accepted as facts.

Dilatata is an alpine or sub-arctic form, finding its natural habitat with the group of species usually classified as alpine, that is, mountain-loving. In the Adirondacks, I have found it only at three thousand feet or above, as at Blue Mt. Probably there are outlying plants scattered below that level, but it is abundant only at that altitude or higher. Lower down, *intermedia* was

common, less so higher up. *Dilatata* is only one of an association of plants found regularly under "alpine" conditions from the Alleghanies northward. Under exceptional circumstances, such plants may occur lower than normal. Such an exception was found in a narrow cold gulch near Rutland, Vermont, at an altitude of fourteen hundred feet, but the environment was so clearly unusual for that altitude that it was a case not of *dilatata* being out of its natural environment but of the environment being out of place.

As with other species of the alpine association, farther north they are found at progressively lower altitudes until coast level conditions comprise their normal, desirable surroundings, because at the coast, as in Labrador, the climate is similar to conditions in the mountains farther south. The coast level plants reported by Mr. Clarkson from Byfield and Brockton, Mass., are probably to be considered as outliers from the north, chance visitors which have happened to find suitable conditions. Along the Maine coast, alpine plants are not infrequent at low levels.

Correspondents in Germany have reported that *dilatata* is there also an alpine form. Their low altitude type is *spinulosa*. Our *intermedia* does not occur in Europe at all. In connection with its alpine environment, *dilatata* has also the widest distribution of these spinulose types, as is true for many alpine species. The whole association tends to occur circum-boreally, in America, Europe, and Asia. *Dilatata* is reported, probably accurately, from eastern Asia; *spinulosa* occurs in Europe and America, while *intermedia*, as already noted, is purely American.

Another point which seems to me well established is found in certain leaf characters. *Intermedia* is truly intermediate with respect to the character of the spinules. In *dilatata* these are open and separate, pointing out-

ward; in *spinulosa* they are appressed, less distinct, and pointing towards the apex of the segment. In *intermedia*, an intermediate condition obtains, on the basis of the examination of numerous leaves. These differences are represented by the figures in the revised edition of Britton & Brown's Illustrated Flora.

Attention has been called to the differences in the texture of the leaves of these three species. Only *intermedia* is available for use as florists' material, to be kept in cold storage for months, because its leaves are so definitely tougher and evergreen. This is shown also by their persistence over winter. *Dilatata* has the most delicate texture, browning and withering with early frosts.

One point of importance has been lost sight of, as it seems to me, in the naming of "varieties" and "forms" with *spinulosa* as the species. We find different forms of this alpine fern separated as distinct varieties of *spinulosa*, with separate names. Is it not more reasonable to keep together under one species, *dilatata*, all these alpine and sub-arctic plants with broad leaves, delicate texture. Surely they have more points of agreement among themselves than of difference when compared with the lowland *spinulosa* and *intermedia*.

Attention may be called to the similarities in leaf characters, habit of growth, and ordinary habitat between *Dryopteris cristata* and *D. spinulosa*. *Intermedia* and *dilatata* tend to produce crowns of rather equal leaves. *Cristata* and *spinulosa* generally show varied size and carriage of leaves, these ranging from tall, fertile, and erect to spreading juvenile forms. Furthermore, if you will lay out for comparison leaves of the four types mentioned so far, you will find that they may naturally be arranged in a progressive series as to outline, marginal characters: *viz.*, *cristata-spinulosa-intermedia-dilatata*. *Cristata* and *spinulosa* also have the same geographical

distribution, Europe and America, and have given rise in both regions to similar hybrids.

My own opinions may be re-stated and summarized as follows: The three spinulose forms of *Dryopteris* found in eastern North America constitute three separate species, well differentiated on the basis of our eastern material in leaf characters, and habitat. *Intermedia* is an endemic American form, practically constant in its characters, always evergreen, always with glandular indusia, inhabitating preferably moist, wooded slopes though found also higher in *dilatata* environment, and lower in typical *spinulosa* situations. The form *Concordiana* is an *intermedia*, more finely divided than the ordinary type.

Spinulosa prefers low, wet, swamp woods, of the sort favored by *cristata*, but may also be found, though less commonly, in association with *intermedia* and with *dilatata*. The leaf is typically twice pinnate, *intermedia* and *dilatata* being thrice divided. *Spinulosa* crowns usually include leaves of varied size. This species occurs both in Europe and America, probably presenting some differences associated with the continental groups, but these groups resemble each other more than they do *intermedia*. At least in the American form the indusia are strictly non-glandular. There are resemblances to *cristata* sufficient to indicate a probable relationship.

Dilatata, distributed over three continents, Asia, America, and Europe, comprises greater variation in some of its characters than the other two, but none the less, may most accurately and practically be treated as a unity in classification, rather than divided and assigned to varietal rank coordinate with *Concordiana* and *intermedia*, as has been done.

It will immediately be observed that the above discussion raises perhaps more points as doubtful than it

assumes to settle. Mr. Clarkson has opened up one line for field work which should be followed up by many observers for a large number of plants. His method of year-round study of considerable numbers of plants in a hardy garden offers an excellent opportunity for definitive study. In any event, let us see if collectively we cannot arrive at an agreement of facts whatever may be the eventual interpretations.

BROOKLYN BOTANIC GARDEN

Two New Ferns from the Dominican Republic[1]

WILLIAM R. MAXON

An additional lot of ferns received on loan from the Berlin Botanical Museum includes two new species, which are described herewith. One of these, represented by an identical specimen in the U. S. National Herbarium, had previously been recognized as new.

Elaphoglossum hispaniolicum Maxon, sp. nov.

Plants epiphytic; rhizome decumbent, short, 2 cm. long, 1 cm. thick, densely paleaceous, the scales tufted, lance-attenuate, 4–6 mm. long, up to 0.8 mm. broad, castaneous, lustrous, rigidly long-ciliate, the cilia dark, oblique. Sterile fronds 4–8, pendent, 12–20 cm. long, laxly paleaceous throughout; stipes delicate, 1.5–3 cm. long, 0.5 mm. thick, densely clothed with spreading rigid scales, these similar to the rhizome scales but shorter and often colored only at the borders; blades narrowly linear, attenuate in both directions, 10–18 cm. long, 9–12 mm. broad, the rachis elevated, clothed beneath with spreading, rigid, dark castaneous scales nearly to the tip; leaf tissue subcoriaceous, semitranslucent, the lower surface clothed with laxly imbricate, long-ciliate, ferruginous scales, the upper surface with a scant covering of similar but somewhat paler and smaller substellate scales; veins

[1] Published by permission of the Secretary of the Smithsonian Institution.

evident, diverging at 50°–60°, simple or once-forked, rarely twice-forked, abruptly arcuate at the clavate tip or sometimes with two short recurved apical branches, these casually joined to adjacent veinlets. Fertile fronds about 20 cm. long, the stipe 6 cm. long; blade conform or nearly so, 18 cm. long, 8 mm. broad, long-attenuate in both directions, the rachis dark-paleaceous beneath as in the sterile fronds.

Type in the Berlin Botanical Museum, collected on a tree trunk, Monte Culo de Maco, Azua Province, Dominican Republic, altitude 1,850 meters, August, 1912, by Father M. Fuertes (no. 1952).

Known only from this collection, which was determined by Brause as a varietal form of *E. hirtum* (Swartz) C. Chr. From that widely distributed species, of which a large series is at hand, including many specimens from Jamaica, the type region, *E. hispaniolicum* differs substantially in its lesser size and much more delicate vascular parts, its extremely narrow linear fronds, its more oblique veins, and its conform sporophylls. *E. hirtum* having strongly dimorphic fronds, veins diverging at an angle of 80°, and the blades of the sporophylls narrowly oblong-linear and invariably rounded at the base.

Diplazium alsophilum Maxon, sp. nov.

Rhizome wanting, presumably stout and erect or assurgent, the fronds rigidly ascending, short-stipitate, conform, 55–85 cm. long; stipe 13–20 cm. long, 2.5 mm. thick, stramineous from a darker base, trisulcate, glabrescent, conspicuously paleaceous at base, the scales borne in a dense tuft, bright glossy brown, linear-acicular, about 1.5 cm. long, 1–1.5 mm. broad, strongly denticulate at the attenuate flexuous tips; blade broadly ovate-triangular, 45–65 cm. long, 35–45 cm. broad, bipinnate-pinnatifid, the rachis similar to the stipe; pinnae 8 or 9 pairs below the long-acuminate tip, contiguous or imbricate, spreading, alternate, the second and third pair largest, 20–25 cm. long, 6–9 cm. broad, oblong-attenuate, the pinnules (about 13 pairs) subdistant, horizontal, mostly sessile or short-stalked, oblong to narrowly tri-

angular-oblong from a slightly inequilateral base, obtuse or acutish, the larger ones obliquely lobed more than halfway to the costa; lobes 6–9 pairs, subtruncate, acutish distally, lightly serrate-crenate, with 2 or 3 pairs of oblique alternate veinlets; sori linear, arcuate, 3–6 mm. long, mostly solitary, borne on the first distal veinlet of each group, extending from near the costule almost to the distal sinus, thus forming a double median row nearly clear of the lobes; indusia pale brownish, narrowly linear, diplazioid or not; leaf tissue bright green, membranous, glabrous.

Type in the U. S. National Herbarium, no. 695652, collected in shady forest near Constanza, Dominican Republic, at an altitude of 1,250 meters, April, 1910, by H. von Türckheim (no. 3218).

The description is drawn partly also from a large specimen, with identical data, in the Berlin Botanical Museum. Both were distributed as *D. oreophilum* Underw. & Maxon, a Jamaican species which differs widely in its broader atropurpureous rhizome scales, its essentially tripinnate subdimorphous blades, its long-acuminate, lanceolate, strongly inequilateral, long-stalked pinnules, and its copiously multisoriate segments. Both species are allied in a general way to *D. Franconis* Liebm., of Mexico and Central America.

WASHINGTON, D. C.

Ferns—Facts and Fancies About Them—II

F. E. Corne

Have you not wondered sometimes why ferns have no flowers? There is an old legend which tells us that up to the time of the nativity they did bear flowers like other plants. On that occasion, however, when all the other plants composing the straw about the Holy Child put forth lovely blossoms in honor of the wonderful event, the ferns alone failed to do so and in consequence were condemned forever after to go flowerless.

But alas for that pretty myth, science tells us a very different story. Cryptogams are infinitely older than the spermatophytes, or seed-bearing plants. It is considered certain that in the course of ages they were evolved from marine plants, and then in their turn evolved the flowering plants. Dr. Percival Lowell, in one of his books, (Mars as the Abode of Life), tells us that, "When the earth was young and still so warm that it was continually enveloped in a thick blanket of steam—warmer everywhere than at the tropics to-day, yet cool enough to support plant life—in the vast marshes which made up so large a portion of the continents, cryptogams composed the greater part of the vegetation attesting by the habits of the ferns of to-day the shady half light in which they must have lived. Gigantic ferns, fifty feet high, others more lowly thirty feet in spread, horse-tails and club mosses dignified to the dimensions of trees spread their incipient leaves from well nigh woodless stems, and grew, flourished, and decayed in almost Jack and the beanstalk like rapidity between 35° and 39° of latitude. Only a warm, humid, and lambient air could have given them such luxuriance and impressed them with such speed."

So we see that they are inconceivably older than flowering plants. They are known from the Silurian period,

but were most abundant in the Carboniferous, coal being composed almost entirely of ferns and their allies. Strata of coal have been found fifty centimeters deep composed of spores alone. If geologists are correct in thinking that coal is reduced to about one eighth of its original bulk, here was a heap of spores which, could it have remained unchanged as it fell during the centuries, would have been fully twelve feet high. What ages upon ages it must have required to assemble such a heap is quite beyond the power of the human mind to conceive. The fact that spores are almost microscopic in size, and that one could collect on the end of a knife the whole harvest of say a large frond of lady fern, which is very prolific, bearing perhaps some fifty or more million, and that thrown on the ground they would disappear like so much dust, gives just a faint idea of the time required. Small ferns grew also in those far away days and some fine fossils have been found, some with sori or clusters of spore cases. By means of these over thirty genera have been discovered which resemble those of to-day, though the species are probably different. The oldest known fossils are estimated to be 100,000,000 years old. I have two petrified specimens from the coal mines of Mauch Chunk, Pa. One looks not unlike a young Christmas fern while the other suggests the ebony spleenwort, and across this a leaf has fallen which resembles a violet leaf in shape, but might have been part of another kind of fern.

Ferns have been studied by scientists for centuries. Zoologists and botanists were alike interested in the fossil remains of the earliest known forms of vegetable life. And the botanist had the added interest of trying to solve the mystery of their reproduction. This was not positively discovered until 1848, not much over seventy-five years ago. The tiny spores had been discovered two hundred years earlier but supposed to be seeds.

In the middle ages when superstition was rife many strange magical powers were attributed to ferns and their allies. Young ferns were constantly found but no seeds. Whence did they come? Other young plants were produced only from seed, so the conclusion arrived at was that there must exist fern seed, but that it was invisible. This being the case, if this invisible seed could be gathered, the happy possessor of it, by carrying it about his person, in his purse or in his shoe, would himself have the power to become invisible at will. Is it not Gadshill who says, "We have the receipt for fern-seed; we walk invisible!" Not finding the necessary flower to produce the seed they invented one. The story was that on St. John's Eve, June 24th, the fern put forth a pale blue flower which rapidly changed into a shining golden seed and this ripened by midnight. Cloths were then spread under the plants, many prayers and incantations were said and the wondrous seed was gathered. Great was their faith, and great must have been their disappointment. No one is reported as having attained the magical gift of invisibility. Yet the fable was believed and the practice continued until sometime in the sixteenth century when it was stopped by the Church as savoring too much of witchcraft or the black art. But the superstition was too strong to be changed at command. Mr. Heath tells of a "respectable countryman of Heston in Middlesex" who in 1779 said that he had frequently been present at the ceremony of gathering fern seed on St. John's Eve, but, he said there were frequent disappointments "as fairies often stole the seed." Instead of sheets, pewter plates were used. Twelve of them were placed under the plant on top of each other and the seeds, falling of their own accord, for the plant must not be shaken, would pass through eleven plates and rest on the twelfth. The seed gatherers had many strange ad-

ventures. One man declared that he distinctly felt unseen spirits striking his hat and different parts of his body. When he could no longer stand this, he went home thinking his platter and enveloping paper to be full of seed. But they were found to be empty. The fairies had stolen it all. Some country people in England, it is said, still retain the belief in the mystic power of fern-seed to render one invisible. The fern in this case is probably the Filix-mas or male fern as it was said that "black spots" fell on it on Midsummer's Eve and the sori of this fern are round and dark, though not ripe in June. Others think that the brake bore the mystic seed, as its spores, borne on the margins of the fronds, and covered with a bit of recurved edge, are unusually obscure. Also brake is very abundant in Great Britain and must be a conspicuous plant as it grows very tall. It has been reported from Ireland thirteen feet high. This fern, which with us is usually about two feet high, in the far north is dwarfed to two or three inches when fully grown, while in the Andes it is said to reach the height of fourteen feet.

Other superstitions were that biting the first unfolding fronds of the Osmunda would insure from toothache for a whole year.

"Break the first brake you see,
Kill the first snake you see
And you will conquer every enemy."

Moonwort, if gathered at the full of the moon, could do wonders. It had the power to unlock a house door if inserted into the keyhole. It could also unshoe a horse running over it in the field, even if newly shod. Burning the brake produced rain and kept away goblins and witches. A cross section cut from the stem of the male fern, or of the brake, was supposed to resemble the cross, and that also, if carried in the pocket, would keep away

witches, goblins and evil spirits. The little brown heaps on the under side of the polypody showed plainly that nature intended it for the cure of tumors, ulcers and the like. But Gerard, the botanist of the 16th century, said that these were all "old wives' fables, and fit only for writers who fill their pages with lies and frivolous tales."

The medicinal qualities of ferns, real or imaginary, we find mentioned as early as 300 B. C. by the Greek philosopher Theophrastus. And Dioscorides, a physician of the time of Nero, whose works were, it is said, referred to as "the fountain head of all authority" for 16 centuries and are still an authority in some far eastern countries, speaks of the brake, male fern and others. Some of the old prescriptions are very amusing. For instance, distilled water made from the roots and leaves of polypody, taken many days together, is recommended against melancholy, fearful and troublesome sleeps and dreams. The Royal fern had the power to heal wounds, and was good for bones broken or out of joint whether applied outwardly, or inwardly in the form of a decoction. Jupiter claims dominion over the Hart's-tongue which is a singular remedy for the liver and good against the passions of the heart and failing of the palate. Adder's-tongue is under the dominion of the Moon and Cancer. "If the juice of its leaves be drank with the distilled water of horse-tail it is a singular remedy for all manner of wounds." An ointment called Adder's-spear ointment is still made of it by some country people which is said to be good for sore eyes, and the bites of adders and other reptiles. Maiden-hair spleenwort was good for keeping the hair from falling off, and for restoring it when fallen.

The Aspleniums or Spleenworts were so called because they were supposed to be good against affections of the spleen. Other ferns were said to be good for colic, colds,

asthma, liver jaundice, fevers and many other and diverse things.

CAMBRIDGE, MASS.

Botanizing on Mount Ktaadn

HAROLD GODDARD RUGG

Ktaadn is undoubtedly the most spectacular mountain to be found in the East. It is the highest in Maine, rising in grandeur to an altitude of 5,273 feet. It has been my good fortune to visit this wonderful mountain on three different years, each time with a party conducted by the Appalachian Mountain Club, that organization which has done and is doing so much to make all the New England mountains more accessible.

There are several approaches to the mountain, all varying in detail. One may go by train to Norcross, Maine, thence by a small steamer across North Twin, Pemadumcook, and Ambejijis Lakes to the west branch of the Penobscot, thence by canoe up the river to the mouth of Abol stream where a tote road and later a trail is found. Or, one may continue two miles further by canoe to the mouth of the Sourdnahunk River, then on foot and by canoe five miles to the Bradeen camps on Kidney Pond. Here a magnificent view of the mountain may be seen. York's camp on Daisy Pond may also be reached from the mouth of the Sourdnahunk River. Another route is by train to Greenville, thence by automobile to Ripogenus Dam and then on to Kidney Pond. To me, however, the most spectacular approach is from Millinocket, going up the Millinocket tote road, with occasional views of the mountain and of beautiful lakes here and there, to Basin Ponds and thence into the South Basin to Chimney Pond, a lovely sheet of water about eight acres in extent located at an elevation of 2,900 feet. Back of the pond

rise perpendicular cliffs towering in a semi-circle to a height of 2,300 feet. This spot is said by many to be the grandest bit of scenery east of the Rockies. At Chimney Pond the Appalachian Mountain Club has erected an open log shelter which will comfortably accommodate four or five people.

It was my good fortune to spend two weeks of the summer of 1923 in the South Basin at Chimney Pond. From the pond the ascent to the table-land via Basin Slide may be made in one and a half hours. From the top of the slide to the highest peak is one mile, and still another mile over the Knife Edge to Pamola Peak (4,819 feet). Because of the unusual weather conditions in the Ktaadn country, one planning to visit the mountain should arrange for a several days' stay. There are nearly always clouds on some part of the mountain and when these cover the immense table-land the danger of getting lost is great. Then, too, it is a region of terrific winds. One day at Chimney Pond the wind came down from the mountain in angry gusts and threw the water of the lake into the air sixty to seventy feet. Again, water in the little brooks flowing down the precipitous slopes of the South Basin was blown up the mountain fifteen or twenty feet like smoke curling upward from a camp fire.

The botanist making a trip to the mountain should familiarize himself with the article on the flora of Mt. Ktaadn in the issue of *Rhodora* for June, 1901. The *Appalachian Mountain Club Guide Book* will prove indispensable in regard to trails; and above all a Maine woods' guide should be secured by the novice.

The fern lover will be disappointed with the small number of ferns to be found. The mountain is composed largely of granitic rock and, like Mt. Washington, does not yield any of the lime-loving alpine ferns which may be found on Mt. Mansfield, Vermont. In the woods about

Chimney Pond may be found *Aspidium spinulosum*, var. *dilatatum*, but in no part of the mountain did I find such tall, luxuriant plants as may be seen in the Green Mountains. In some exposed places the plants are much stunted. The best botanizing is found along the head wall of the North Basin. Here *Phegopteris polypodioides* was growing abundantly at an elevation of 4,500 feet. A single plant of *Phegopteris Dryopteris* and one of *Asplenium Filix-femina* were found at this altitude. The only specimen of *Lycopodium sitchense* collected was discovered on this wall. One is disappointed in not finding any rock-loving ferns, although here *Phegopteris polypodioides* is found very abundantly on the various slides and under the rocks. No plants of *Polypodium vulgare* or *Woodsia ilvensis* were seen in any of the walks taken. About Chimney Pond *Lycopodium lucidulum* was abundant in the woods and at a lower elevation. *Lycopodium clavatum* is common. *Lycopodium annotinum* is common as one goes up the slopes and is abundant on the table-land, passing into the var. *pungens*. Under the big boulders, generally at an elevation of about four thousand feet, and also in protected places on the table-land and the cliffs just below is an abundance of *Lycopodium Selago*.

The immense table-land is carpeted with *Rhododendron lapponicum*, *Arenaria groenlandica*, *Diapensia lapponica*, *Empetrum nigrum*, *Salix Uva-ursi*, and varieties of *Vaccinium*. In places on or near the summit *Arctostaphylos alpina* is abundant. *Phyllodoce caerulea*, *Loiseleuria procumbens*, and *Cassiope hypnoides* may be met in the ravines and slides leading to the top. In the North Basin only did I find *Arnica mollis* and *Castilleja pallida*, var. *septentrionalis*. It was my good fortune to rediscover Professor Fernald's two stations for *Saxifraga stellaris*, var. *comosa*, the only stations in the eastern United States

for this rare plant. In the chimney of the South Basin I found a few plants of *Saxifraga Aizoon*, not mentioned in the *Rhodora* article.

If one wants to climb one of the most spectacular mountains in the East, wants to get a panoramic view studded with lakes of great beauty, and wishes also a good collecting ground for flowering plants, surely no better spot can be found in New England than Mt. Ktaadn.

HANOVER, N. H.

Some Pteridophytes of the Western Catskills

ARAVILLA MEEK TAYLOR

Probably few sections of our country are richer in pteridophyte flora than the Catskill Mountains, but to many botanists, as well as to the tourist, the "Catskills" mean the region about Slide Mountain, the highest peak of the range, or the vicinity of the popular summer resorts. Visitors as a rule do not approach the mountains from the west, so that the mesophytic forests and delightful mossy swamps of that section are little known.

In forest and swamp, ravine and open field, ferns and clubmosses are abundant. The following pteridophytes were all easily located on one farm of two hundred acres or less near the village of Andes, in Delaware County. The list is probably not complete even for this small area. No one is distinctly rare, but the great abundance in species and total numbers makes the place a delight to the fern lover. One may sit on a fallen tree trunk in the old swamp forest and count eight or ten species of ferns within sight, indeed, almost within touching distance, and from one old log up nearly at the top of a mountain at the margin of the beech-maple forest I counted six species and varieties of *Lycopodium*. One often chances upon the greatest treasures in the least ex-

pected places, as while picking wild blackberries in a hot open hillside pasture one afternoon, I glanced down upon a thrifty patch of *Ophioglossum vulgatum* L.

It was not far from this same farm, in a little ravine, that I came across the only case of *Polypodium vulgare* L. growing as an epiphyte that it has been my fortune to find in these hills. While only about two feet up on the somewhat moss covered trunk of a small tree there was no indication of rhizome connection with the ground. The tree stood above the bed of a small stream which contained little water during dry weather although forming a series of falls up the ravine when water is plentiful.

During the summer of 1923 I found many specimens of *Lycopodium complanatum* var. *flabelliforme* Fernald, with spikes bifid or trifid. Other plants of the same species had frequently only one spike out of the four of normal size, while the other three were rounded and very much dwarfed. I have never before noted the latter condition with such great frequency, and it may be a reaction to the unusual dryness of the season. Most of these plants were growing on a very steep open hillside where the surrounding vegetation had been somewhat closely cropped by cattle, thus reducing the shade to which they were usually subject to a considerable degree.

In the following list the 7th Edition of Gray's Manual has been used in classification.

CLUBMOSSES

Lycopodium annotinum L.

Lycopodium clavatum L.

Lycopdoium clavatum var. *monostachyon* Grev. & Hook.

Lycopodium complanatum L.

Lycopodium complanatum var. *flabelliforme* Fernald.

Lycopodium lucidulum Michx.

Lycopodium obscurum L.
Lycopodium obscurum var. *dendroideum* (Michx.) D. C. Eaton.
Lycopodium tristachyum Pursh.

GRAPE FERNS

Botrychium lanceolatum var. *angustisegmentum* Pease & Moore.
Botrychium obliquum Muhl.
Botrychium obliquum var. *dissectum* (Spreng.) Clute.
Botrychium ramosum (Roth) Aschers.
Botrychium virginianum (L.) Sw.
Ophioglossum vulgatum L.

FERNS

Adiantum pedatum L.
Asplenium acrostichoides Sw.
Asplenium angustifolium Michx.
Asplenium Filix-femina (L.) Bernh.
Asplenium platyneuron (L.) Oakes.
Aspidium cristatum (L.) Sw.
Aspidium cristatum var. *Clintonianum* D. C. Eaton.
Aspidium Goldianum Hook.
Aspidium marginale (L.) Sw.
Aspidium marginale var. *elegans* J. Robinson.
Aspidium noveboracense (L.) Sw.
Aspidium spinulosum var. *intermedium* (Muhl.) D. C. Eaton.
Aspidium Thelypteris (L.) Sw.
Cystopteris fragilis (L.) Bernh.
Dicksonia punctilobula (Michx.) Gray.
Onoclea sensibilis L.
Onoclea sensibilis var. *obtusilobata* (Schkuhr) Torr.
Osmunda Claytoniana L.
Osmunda cinnamomea L.

Osmunda cinnamomea var. *incisa* J. W. Huntington.
Phegopteris Dryopteris (L.) Fée.
Phegopteris hexagonoptera (Michx.) Fée.
Phegopteris polypodioides Fée.
Polypodium vulgare L.
Polystichum acrostichoides (Michx.) Schott.
Polystichum acrostichoides var. *incisum* Gray.
Pteris aquilina L.

Recent Fern Literature

As is well known, the leaves of the "resurrection fern," *Polypodium polypodioides* (*P. incanum*), curl up in dry weather with the lower surfaces, which are densely covered with scales, outward. From this behavior it might readily be assumed—and unless the present writer is much mistaken, it has been assumed—that the covering of scales lessened evaporation from the lower surface of the leaf and that the turning of this surface outward served to prevent too great loss of water.

However, Dr. L. J. Pessin, who has been investigating the matter, finds that nothing of the sort is the case. He coated the upper surfaces of certain leaves and the lower surfaces of others with vaseline, thus effectively sealing them against the passage of water. Then he dried out both groups in desiccating apparatus in the laboratory, measuring the amount of water given off by weighing the leaves from time to time. Evaporation from the lower, scale-covered surface, proved to be nearly twice as rapid as from the apparently unprotected upper surface. On the other hand, when water vapor was supplied to the desiccated leaves, the lower surface absorbed it nearly ten times as fast as the upper.

It would seem, then, that curling up with the lower surface outward does not greatly diminish evaporation, but does expose to the rain, when it comes, that portion

of the leaf which can make the best use of it. Dr. Pessin thinks that the function of the scales may be to catch the rain water and hold a film of it against the surface of the leaf. This view is favored by the remarkably rapid recovery of the plant after drought, much more rapid than it could be if water were taken up only by the roots.[1]

In the course of a study of the flora of Tahiti, made under the auspices of the Carnegie Institution of Washington during 1922, Prof. Setchell and H. E. Parks secured a considerable collection of the pteridophytes of that island. So little has been written about the ferns of Tahiti, taken by themselves, that it has seemed worth while to put on record a complete list of this collection. Such a list has been prepared by Dr. Maxon and published by the University of California in its usual excellent style. Sixty-six species are included, three of them described as new and others of great rarity. The collectors have set an excellent example to other workers in the tropics by preserving very full records of habitat.[2]

Biologists of the United States National Museum have recently made botanical collections of much interest in the Island of Hispaniola. The ferns contained in them, together with certain collections loaned by the Botanical Museum at Berlin, have been studied by Dr. Maxon, who has published three lists, comprising altogether a total of 68 species, most of which have not previously been known from the island and several of which are new to the West Indies. Eight are described as new to science, and a

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[1] Pessin, Louis J. A physiological and antomical study of the leaves of *Polypodium polypodioides*. Am. Journ. Bot. **11**: 370–381. 1 pl., 2 figs. June, 1924.

[2] Maxon, W. R. Report upon a collection of ferns from Tahiti. Univ. Cal. Publications Bot. **12**: 17–44. 6 pl. May 27, 1924.

ninth has been known for over two hundred years only from an old, pre-Linnaean plate of Plumier.[3]

Dr. Maxon has also described a third species of *Atalopteris*[4] and two new species of that curious genus, *Jamesonia*,[5] from South America. He has himself been collecting in a little-known region of Costa Rica and is reported to have brought back some 4,500 specimens, a fair proportion of them, no doubt, ferns.

Some time ago the *Maine Naturalist* announced that it would devote the botanical portion of one of its numbers to ferns. The result was so large a number of local fern lists from various nature-lovers of Maine that they have run over into subsequent numbers. The current issue (vol. 4, no. 2, May 1, 1924) contains two such lists. Olaf O. Nylander discusses 17 species of Aroostook County, including *Aspidium Goldianum*, not previously reported from that region; and Mrs. Fred H. Pitman records 30 species from the vicinity of Winthrop.

Dr. Benedict has added a few more facts and six excellent illustrations to his account of the new viviparous sport of the Boston fern. (See this JOURNAL **13**: 122.) It has been christened the moss-leaved fern. It has also received a Latin horticultural name, *Nephrolepis Trevilliani*, in honor of Mr. J. T. Trevillian, of the Pierson nurseries, who first discovered this and numerous other

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[3] Maxon, W. R. New or critical ferns from Haiti. Journ. Washington Acad. Sci. **14**: 86–92. Feb. 19, 1924. New or noteworthy ferns from the Dominican Republic. Proc. Biol. Soc. Washington 37: 97–104. Feb. 21, 1924. Further notes on Hispaniola ferns. Journ. Washington Acad. Sci. **14**: 195–199. May 4, 1924.

[4] A third species of Atalopteris. Proc. Biol. Soc. Washington **37**: 63–64. **Feb. 21, 1924.**

[5] Two new species of Jamesonia. Journ. Washington Acad. Sci. **14**: 72–74. **Feb. 4, 1924.**

interesting forms. Though growing and reproducing rapidly, the moss-leaved fern has little or no commercial value, on account of its extreme sensitiveness to variations in the supply of moisture. Its offspring shows reversion in a wide variety of leaf-forms, all the way back to the once-pinnate type of the original *bostoniensis*. No surely stable once-pinnate reversion has been detected, but one could probably be obtained by selection. No further progressive variations, in which the characters of *N. Trevilliani* would be intensified, are to be expected. A Boston fern three inches high, with the narrow segments of the indefinitely branching leaves so interlaced that the whole looks like a tuft of moss, may well be supposed to have reached its limit.[6]

Mr. Henry Mousley has published another of his readable reports on the ferns of Quebec. This one records the results of the season of 1923. The finding of *Botrychium simplex*, *B. virginianum*, var. *europaeum*, and *Athyrium angustum*, var. *elatius*, at Hatley, brings the census of species and varieties of ferns there to a total of 51. Mr. E. B. Chamberlain and Mr. C. H. Knowlton discovered the walking fern at St. Cyr and Philipsburg, respectively. Both stations are eastward extensions of range for the province, the former of about 75 miles. Mr. Knowlton also found the ebony spleenwort at Philipsburg. This is the third station for Quebec and an eastward extension of range of about 50 miles.[7]

In the first number of *Torreya* for 1924 (**24**: 10–11) Prof. Cockerell figured and described, as a "perfectly

---

[6] Benedict, R. C. The moss-leaved fern. Journ. Heredity **15**: 18–24. 6 figs. Jan., 1924.

[7] Mousley, Henry. Further notes on the ferns of Hatley, Quebec. Can. Field Nat. **38**: 50–51. March 14, 1924.

genuine Ophioglossum'' and under the name of *O. hastatiforme*, n. sp., a fossil fern from the Wind River formation in Wyoming. Now Prof. Berry courteously points out, on the basis of a dozen other collections of the same plant, that it is not an Ophioglossum, or even a new species, but *Danaea coloradensis* Knowlton. The incident may be taken as an illustration of the difficulties under which palaeontologists labor in assigning to genera and species the fragmentary specimens with which they have to work.[8]

ASPLENIUM MONTANUM IN MASSACHUSETTS.—As long ago as the old year 1768 Gilbert White, of Selborne, England, wrote, ''that that district produces the greatest variety which is the most examined.'' The truth of this sage observation is well exemplified in many lines of effort to-day, in this comparatively new country of ours. In order to extend or maintain a full vigilance over a given district, whether in avi-faunal or botanical fields, we would do well to employ that sort of ''police patrol'' Thoreau has been characterized as having extended over his Concord environs. Pertinent to this thought also are Thoreau's own words, that ''many an object is not seen though it falls within our visual ray, because it does not come within the range of our intellectual ray. So in the larger sense we see only the world we look for.'' So much for the text of my sermon, which is really no sermon at all but merely preface to the announcement of the finding of a fern not previously reported from Massachusetts. The analogy perhaps needs no further comment.

On May 4th, 1924, at Monument Mountain, Great Barrington, at an elevation of about 1,600 feet, near the

---

[8] Berry, E. W. *Ophioglossum hastatiforme* Ckl. not an Ophioglossum. Torreya **24**: 49–50. 1924.

Where the Mountain Spleenwort deserves its Name.
The Station at Great Barrington, Mass.

Stockbridge-Great Barrington boundary, while making some photographic studies of nesting falcons or duck hawks, I found on the precipitous quartzite cliffs of the place some twenty plants of *Asplenium montanum*. In their exposed situation, on the northeasterly face of the cliffs, they had not come through the winter in very good condition, and at the time I was somewhat doubtful of their identity. But from specimens sent him Mr. C. A. Weatherby has kindly verified the species, and several subsequent visits to the station have established the fact beyond possibility of question. To fern lovers this will be of interest not only as a new species for Massachusetts, but as an extension of its range some few miles farther north than it has been previously reported. The very rugged and precipitous nature of this station will serve. I believe, as a pretty certain guaranty against undue molestation.—S. WALDO BAILEY, WILLIAMSTOWN, MASS.

THE HERBARIUM OF GEORGE E. DAVENPORT.—Many members of the Fern Society doubtless know of the Davenport Fern Herbarium, a collection of representative specimens of the pteridophytes of North America north of Mexico given by Mr. Davenport to the Massachusetts Horticultural Society some forty years ago. Very few of us knew—at least until we found it referred to in *The Fern Lover's Companion*—that Mr. Davenport retained another collection, which grew to be by far the larger and which, after his death, was kept by his family until December, 1922. Then his daughter, Miss Mary Elizabeth Davenport, presented it to the Gray Herbarium of Harvard University.

As there received, it numbered about 4,500 sheets from all parts of the world, some of them of exceptional interest—such as, for instance, the type specimens of all

the species and varieties described by Davenport from Mexico. Practically all the specimens were unmounted; the work of mounting them and incorporating them into the Gray Herbarium collections has taken a good deal of time, but is now completed.

With the specimens came a considerable number of letters, some of them casting side-lights on the characters and opinions of botanists of the past generation and some narrating incidents of interest. One of these, sent by Prof. Eaton to Davenport with a specimen of *Cheilanthes lanosa* from its northernmost station at New Haven, Conn., is worth quoting here.

Dec. 17, 1892.

My dear Mr. Davenport:—

Have a fern new to New England! and gathered within three miles of my house. Mr. Van Ingen climbed a trap rock cliff till he could get neither up nor down, found this fern, and waited till men let down a rope from the top and hauled him up. I do not think I shall try it—though I did climb clear to the top 42 years ago.

Yours very truly,

DANIEL C. EATON

THE EARLIEST RECORD OF PROLIFEROUS EBONY SPLEENWORT.—In looking over the Davenport Herbarium, after Miss Marshall's paper on proliferous ebony spleenwort had appeared and Mr. Floyd's was in type, I ran across a specimen of D. C. Eaton's *Asplenium ebeneum*, var. *proliferum*, sent by Eaton to Davenport. On the sheet Davenport had written a reference to an early account of the plant which everyone but he has apparently overlooked. This account is to be found in an English publication, Loddiges's Botanical Cabinet, devoted to botanical illustrations, and occurs in vol. 1 under plate 5. It probably dates from 1816. It states that the ebony spleenwort (queerly enough) does not thrive in England

without some artificial heat and that "it appears to propagate itself in a most curious manner by young plants growing out of the stipes." The plate represents an ordinary fertile frond and a proliferous frond which is also fertile, at least at the tip.

It will be noted that this record, implying, as it does, that proliferation regularly occurred in the plants—few, to be sure—then under observation, bears out Mr. Floyd's suggestion that the species probably takes to this alternative method of reproduction under unusual and unfavorable conditions of growth.—C. A. W.

ASPLENIUM PLATYNEURON, VAR INCISUM IN CONNECTICUT.—Once a year my husband and I plan for a night in the open. This gives us two days' botanizing at places inaccessible to automobiles. It was on one of these trips we found *Asplenium platyneuron*, var. *incisum*.

The especial object of this walk was a pond up on the side of Perkins Mt., Somers, Conn. The morning passed with no finds of unusual interest, but on resuming our walk after lunch things began to happen almost at once. "What are you doing here?" I heard my husband say to a plant, and I soon discovered he was talking to a *Lespedeza* which wasn't supposed to grow in that part of the State. Within a dozen yards he found at least a dozen plants either rare or extensions of range in Connecticut. Not to be outdone I began to see what I could find. On glacing up the shaded roadside bank I saw five very upright fronds which suggested ebony spleenwort, but were quite unlike the dozen or so I had passed. I became quite excited and could hardly wait for my husband to finish examining the plants he was interested in. This really beautiful fern proved to be the incised form of the ebony spleenwort which has only six reported stations in the United States.

As it was in range of the road-mender's scythe, we dug up the plant and brought it home. Its fronds were from 10 to 14 inches long, of a paler green than the typical form, and so deeply cut they looked as if they had green ruffles on each side of the midrib. Unfortunately (as emphasized by Davenport in his description) the stipes are much more brittle than in the ordinary form, making it difficult to handle or grow.—UNA F. WEATHERBY.

American Fern Society

One of the few foreign members of the Society, and one of the most distinguished, His Imperial Highness, Prince Roland Bonaparte, died in Paris, April 14, 1924. He was born at Auteuil, near Paris, May 19, 1858, the grandson of Lucien Bonaparte, second brother of Napoleon I. He entered the military school of St. Cyr and on his graduation in 1879 was commissioned lieutenant. But though, like his father, he was a loyal supporter of the republican government, he was forced from the army by the act of June 22, 1886, which forbade any member of a family which had reigned in France to serve as a soldier.

From that time Prince Bonaparte's activities were devoted to science. He travelled in many parts of the world, his active mind touching on numerous lines of enquiry. He brought back material for books on the discoveries of Tasman, the colonial work of the Dutch in New Guinea, the inhabitants of Surinam, and the people of Lapland. But his main interest was in ferns and their distribution.

He gathered probably the finest private herbarium of ferns in existence, numbering some 300,000 specimens. The great resources of this collection and of his magnificent library were employed in the preparation of a series of fern papers, entitled "Notes Ptéridologiques." The

main object of these papers was to publish the determinations of newly collected sets acquired by him and of unnamed specimens in older sets in such form that they would be useful to workers with other herbaria which possessed duplicates of the sets. In some cases, this work expanded into fern floras—those, for instance, of Madagascar and Indo-China. Prince Bonaparte published the "Notes" at his own expense and distributed them freely to institutions and individuals. It is stated that he died pen in hand, just as he was writing the last words of the last of the series.

The wealth which enabled him to get together his great collections was also generously used to aid the work of others. Beside many gifts, made directly by himself to the recipients, he established the "Fonds Bonaparte," awarded annually by the Paris Academy of Sciences.

He was a member of the Institut de France and a member and officer of many scientific societies. Numerous scientific honors had been bestowed upon him, including degrees from the Universities of Cambridge and Upsala.

The JOURNAL is again indebted to Mr. E. H. Clarkson, this time for defraying all the cost of the frontispiece which appears in the present number.

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E. J. WINSLOW C. A. WEATHERBY

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American Fern Journal

Vol. 14 OCTOBER–DECEMBER No. 4

New Tropical American Ferns—I[1]

William R. Maxon

Among the large collections of tropical American plants received at frequent intervals by the National Herbarium there are many hundreds of ferns for identification, these including a considerable number of undescribed species. Frequently the names are needed for immediate use; and since very often it is not practicable to prepare revisions of the groups to which the new species belong, it is thought desirable to assemble descriptions of some of the more important ones in a series under a common heading, as above. Critical group studies or synoptical revisions are, of course, the most pressing present need in the taxonomy of the ferns, but the number of students is so small that current demands of identification leave scant time for more important work.

Cyathea dryopteroides Maxon, sp. nov.

Trunk erect, about 60 cm. high; fronds (incomplete) about 1 meter long, nearly or quite exstipitate; blades oblanceolate, gradually narrowed to a tapering base, abruptly acuminate at the apex, 30 cm. broad above the middle, nearly bipinnate; primary rachis dull castaneous, 5 mm. thick at the terete base, minutely and deciduously furfuraceo-puberulous beneath, laxly paleaceous on the upper side, the scales mostly filiform, 5–7 mm. long,

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[1] Published by permission of the Secretary of the Smithsonian Institution.

about 0.1 mm. broad, yellowish brown, curved; pinnae numerous, spreading, alternate, sessile, subdistant, the lowest somewhat deflexed, about 1 cm. long; largest pinnae narrowly elongate-triangular, 16 cm. long, 3.5 cm. broad at base, evenly long-acuminate in the apical third, fully pinnate at base (the first proximal pinnule usually free), deeply pinnatifid throughout (to 0.5 mm. from the costa); costae densely hirsute-strigose above, deciduously imbricate-paleaceous beneath, the scales lance-ovate to lance-attenuate, about 2 mm. long, dark lustrous brown with pale borders; segments 22–27 pairs, linear-oblong, 1–1.8 cm. long, 3.5–5 mm. broad, slightly oblique, subfalcate, lightly joined at the dilatate base, coarsely crenate-serrate, deeply so at the acutish tips, the margins closely revolute; costules subflexuous, elevated above and bearing a few curved spinous hairs, nearly naked beneath, a few minute, deciduous, yellowish brown, subbullate, lanceolate scales borne along the basal half; veins 7–9 pairs, mostly once-forked, elevated above, the branches diverging at a wide angle; sori 3–6 pairs, inframedial but clear of the costule; indusia cyathiform, dark brown, firm, glabrous, about 1.3 mm. broad, the receptacle large, capitate, included. Leaf tissue herbaceous, dull green above, much paler beneath, glabrous.

Type in the U. S. National Herbarium, no. 1,145,760, collected in mountain forest, Monte Cerrote, near Adjuntas, Porto Rico, at 900 to 1,050 meters elevation, March 15, 1915, by N. L. Britton and Stewardson Brown (no. 5424). A second specimen of the same number in the herbarium of the New York Botanical Garden has yielded additional data.

Cyathea dryopteroides belongs to the small group of *C. minor* D. C. Eaton and is closely allied to *C. Abbottii* Maxon,[2] of the Dominican Republic. The latter species differs, however, in its closely placed, ligulate pinnae (which are not broadest at the base), in its more numerous, closer, narrower, and much less strongly crenate-serrate segments, and in the character of the costular scales, these ovate to orbicular in outline, very deeply bullate, persistent, and evident to the naked eye.

[2] Proc. Biol. Soc. Washington 37: 99. 1924.

Leptochilus hemiotis Maxon, sp. nov.

Plants terrestrial. Rhizome horizontal, creeping, about 8 cm. thick, subterete, densely paleaceous at tip, the scales dark castaneous, oblong-lanceolate, 8–10 mm. long; fronds few, closely distichous, suberect. Sterile fronds 50–65 cm. long, the stipe a little shorter than the blade, 3 mm. thick, light brownish-olivaceous from a darker base, subangulate, glabrate; blades orbicular-oblong, 30–35 cm. long, 28–30 cm. broad, pinnate, the rachis subflexuous; pinnae 2 or 3 pairs and an enlarged terminal one, the lateral ones subalternate, slightly oblique, elliptic-oblong to oblanceolate-oblong, 18–21 cm. long, 6–7.5 cm. broad, acuminate at apex, mostly gemmiparous in the axils; the basal ones short-stalked (2–4 mm.), with a rounded nearly equilateral base, the others sessile, strongly inequilateral at base, rounded-auriculate below, above abruptly excavate (2–3 mm.) and cuneate, the base thus semicordate; terminal pinna broadly rhombic-ovate, acuminate at base and apex, up to 25 cm. long and 13 cm. broad; margins lightly sinuate; main veins arising 8–15 mm. apart on either side at an angle of 45° to 50°, elevated, subflexuous, slightly arcuate; transverse veins 7 or 8 pairs, flexuous-arcuate, elevated, hardly thicker than the minor venation; areoles large, polygonal, the elongate costular ones with a pair of produced free vein-branches, these divaricate, simple or 1–2-forked; leaf tissue dark green, membrano-papyraceous, the venation evident. Fertile fronds 75 cm. long or more, the stipe and rachis dull stramineous, distantly appressed-paleaceous; blades oblong, 22–32 cm. long, 12–13 cm. broad, pinnate; pinnae 2 or 3 pairs and a slightly larger terminal one, alternate, sessile or the lower ones petiolulate, elliptic-oblong to ovate-oblong, 6–10 cm. long, 2.5–5 cm. broad, rounded-acutish at apex, all but the basal ones semicordate at base; midribs evident beneath, appressed-paleaceous at base; veins wholly concealed.

Type in the U. S. National Herbarium, no. 833896, collected in the island of Trinidad, British West Indies, 1877–1880, by A. Fendler (no. 101). Two other sheets of the same collection are at hand; also a juvenile specimen collected in a wet forest gully at Morne Bleu, Trinidad, March 13, 1921, by Britton, Freeman & Bailey

(no. 2256).

Leptochilus hemiotis belongs to the group of *L. nicotianaefolius* and is well distinguished by the semicordate bases of the pinnae, these mostly gemmiparous as in *L. Bradeorum* Rosenst., of Costa Rica.

Notes on Scolopendrium vulgare Sm.

MABEL R. HUNTER

Some time ago an article was published on the status of *Scolopendrium vulgare* Sm. in New York State.[1] Since the observations there recorded were made several interesting items have been noted.

Station E, West White Lake Substation, has been covered with the blastings of quarrying operations. The writer was able to rescue some of the plants, a few of which were planted in the Jamesville Woods region. The remainder were sent upon request to Dr. McFarland at the University of Kentucky. While it is probable that the colony is entirely destroyed there is a possibility that a few plants may have survived as was apparently the case in the Split Rock region several years ago. A very careful survey of the region will be made as soon as the quarrying work ceases.

The excavations are being continued along the ridge between this station and station C, the Green Pond Substation. Before the end of the season this colony will also be blasted out. Fortunately, through the recommendation of Dr. Homer D. House, State Botanist, the New York State Museum, of which Dr. John M. Clarke is director, came to the rescue and offered financial aid necessary to move all the plants in this colony to a place of safety. When the work was started it was seen that

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[1] Hunter, Mabel R. 1922. The Present Status of Scolopendrium vulgare Sm. in New York State. Am. Jour. Bot. 9: 28–36.

the number of plants had increased greatly since the general survey four years ago. The plants were growing at the top of the cliff in the open, also down the side of the slope for about twenty feet. They were more abundant at the top in the open. Here two hundred and fifty mature plants were taken from an area ten feet square, beyond this no count was taken. These plants have been transplanted to a ravine in the Jamesville Woods region, (substation H). The particular ravine selected is one in which no plants were originally found, but experiments previously performed show that *Scolopendrium* will thrive there. A few plants were sent to Dr. House and planted in a likely place between South Bethlehem and Ravena.

Recently several colonies in other parts of the state have been reported. Investigation has shown that these colonies were started with plants taken from the central New York area. The writer has first hand knowledge of only two of these. Dr. House set some plants near Munnsville, Madison Co., about twenty years ago. He reports that four years ago this colony was growing but apparently had increased but little. Mr. Leland Slater, of Kent, Conn., found a small colony near Coxsackie, N. Y. Investigation showed that it was planted there by Miss Charlotte Bogardus of that place some years ago. It apparently has not done well.

Dr. McFarland reports that the plants sent to him grew thriftily, producing abundant fronds but no sori. Similar reports have been received from people to whom plants have been sent as greenhouse specimens. Whether this is a peculiar reaction to certain environments or only a natural result of transplanting can be determined only after several seasons of growth. The writer, however, has had no trouble in growing under greenhouse conditions plants which produce fronds with mature sori

in five months time. Spores from these sori have been sown on several types of culture media and germinate readily.

The problem of reaction of plants to transplanting is an important one in determining necessary environmental conditions. Hence if anyone reading this article can furnish any accurate information concerning attempts at transplanting or growing *Scolopendrium* it will be gratefully acknowledged.

SYRACUSE UNIVERSITY

What unusual Fern-finds have YOU made? Please tell us.

W. R. MCCOLL

Drifting along fern channels, on shady creek banks, from copse to field, on sloping banks, and marshy meadows with congenial company, what, to a fern fancier, could be more interesting than listening to the experiences of an enthusiast retailing to sympathetic ears his latest fern finds, his hopes, his disappointments and his joys in finding at last the long looked for specimen that **for years has eluded his grasp?**

Every collector finds some puzzling forms, freaks, and hybrids that are known to him to be most unusual and must prove of intense interest to every collector worthy of the name. Several specimens of these ofttimes nearly unique varieties are sometimes taken from one plant. What I suggest is, that each member relate to the best of his ability his experiences in the pages of the FERN JOURNAL, each issue, giving all the benefit and knowledge of these unusual finds. I feel it would brighten the pages of our journal and assist in making it intensely interesting to our membership, besides giving opportunity for making advantageous additions and exchanges with each other.

Crested Silvery Spleenwort

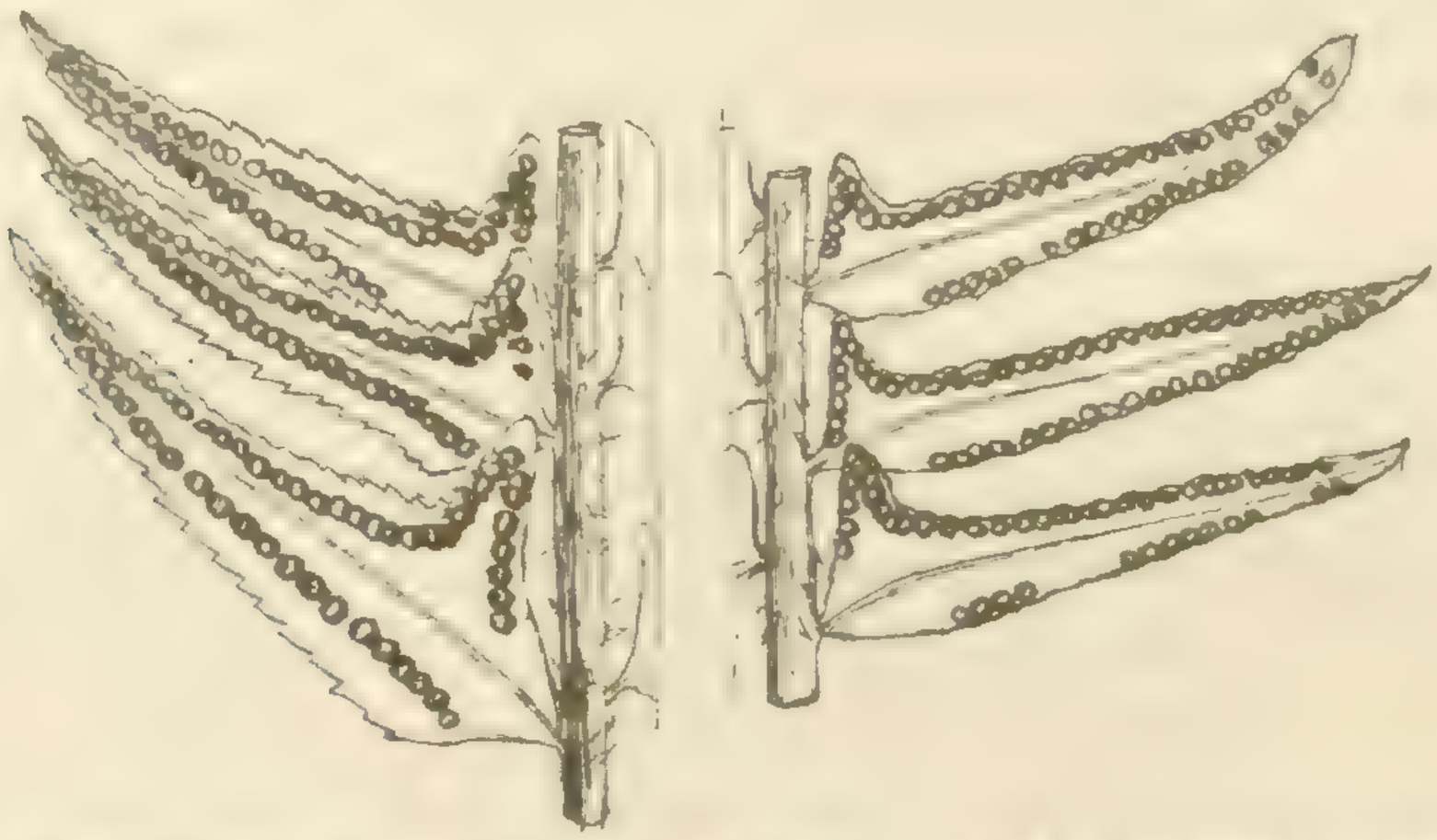
Come with me for a little while; stop, look, and listen, to the first of the series.

When a lady hailed me late last fall to come and look at this funny looking fern beside the veranda, I drew back a large *Aspidium spinulosum intermedium*, and crowded behind it in a shady angle of the building I found *Athyrium thelypteroides* (the silvery spleenwort) beautifully cristate on apex, pinnae and pinnules. I was surprised, delighted, yes, I think covetous as well, for I did not know of its existence in that form; and, upon investigation in both the FERN JOURNAL and the *Fern Bulletin* I failed to find the variety previously mentioned. Possibly you can imagine my surprise when I was told to take the fronds with me as the frost would soon claim them anyway.

For your information I might say, the plant was an ordinary sized specimen of the common type, brought in from a farm 3 years previously, and did not assume the cristate character until the second year in its present location. This year being its third season, has only intensified the beauty of the new fronds, but the intense heat of late summer followed by early frosts destroyed their green freshness and somewhat dried them prematurely. **(Illustrated on Plate 7.)**

Ten miles from here at the village of Woodford I once peeped into a limestone crevice on the roadside, in the sun, and pulled out *Polystichum lonchitis* measuring twenty-five to twenty-seven inches long; on a later visit I glanced into the same opening and found the same fern, the stipes of which were crooked, wavy, and undulating, supporting heavily fruited fronds with dark rich brown sori. At another visit I secured six fronds with tips coiled or curled around in a circle making a handsome cristate appearance which might more properly be described as star shaped in outline.

That crevice had not yet yielded me its finest treasure until I reached down and lifted, rootstock and all, a handsome plant of ten fronds averaging about twenty inches long, which upon examination proved to have the sori on the very edge of the pinnae, large, round, and rich, dark brown. This form I am given to understand is as yet unrecorded; it seems so remarkable that it may be called *Polystichum lonchitis*, forma **marginale**, n. f. The accompanying sketch shows pinnae of f. *marginale* and of the typical form for comparison. The locality



POLYSTICHUM LONCHITIS, TYPICAL FORM (LEFT) AND F. MARGINALE (RIGHT)

is at the spot where H. E. Ransier on his visit here for this fern and *Scolopendrium vulgare* saw the black squirrel as he described in his article in the JOURNAL Vol. 3, no. 2, p. 33, 1913.

Just across the road, tucked away in a similar crevice in an old orchard, a wonderful plant of the same species was found growing in flower pot shape, with fronds crowded and imbricated so closely as to hold a large quantity of leaves from the apple trees overhead. In mounting this specimen I left the egg shaped caudex attached and the plant spread out into a beautiful circle or cart wheel shape, containing twenty fronds, the egg-shaped root showing apparently about sixteen layers of

annual additions to the caudex, with a mass of fiber-like rootlets fifteen inches long, and several inches wide attached to the rock face inside the crevice.

Adiantum pedatum is not difficult to obtain in variant forms, but when one drops on a plant containing fifteen fronds with all the pinnae contorted or coiled, once, twice, and three times, until each frond is completely curled out of type form, all beautifully green, and healthy, growing upon a yellow disintegrated rotten log, the stipes deep wine color, and not a single frond fruited, although taken in October, it is apt to make one's breath come in short pants. I took nine fronds, leaving six for the following season for study, only to return and find the station destroyed, the protecting trees removed, the ferns uprooted, possibly by orders of the Park Commission in this city; on the borders of whose domain the plant was found growing. The old adage, of a little, take a little, and leave a little, was not quite a success in this instance.

Pellaea gracilis is spoken of in the fern books as ranging in size from two to six inches and that is substantially correct; but, there are exceptions. Glancing up, along a limestone rock face, running east and west near our city, I saw that there projected a mass of limestone running north and south, facing the east and shaded by foliage growing upon heaped-up rock talus. In rear of the trees was a narrow crevice filled with moist black mold from which was draped (protected from the morning sun) a bunch of the largest and healthiest *Pellaea gracilis* one would wish to see. Clambering up possibly thirty feet, I removed singly, and carefully, each splendid frond, and found them to measure eight to thirteen inches, which to me was enough joy for one day.

If *Asplenium trichomanes* were found containing fifty fronds one would consider oneself fortunate in finding such a plant; yet, dame fortune recently turned my at-

tention to a rock depression possibly eight feet deep, on the inner face of which was growing in semicircular form a plant garnished with a wondrous showing of two hundred and fifty of the finest green fertile fronds, all perfect and fully fruited, and with long fibrous roots, eight inches wide, by eighteen inches long.

Peering over the edge of a calcium carbonate rock about twenty feet in length, upon which I was standing, I noticed a longitudinal crack in the rock fragment of about ten feet in length, which was filled with damp, dark, rich mold, growing out of which was the largest plant of *Asplenium viride* one could possibly wish to see. This really unusual specimen contained one hundred and sixty-eight fronds each perfectly fruited, green, and healthy. It should be said here that the slab tilted slightly to the north allowing the rainfall to drip over the edge or face of the rock, and seep into this crevice, giving all available nourishment to the plant which had made its home in such a healthful situation.

Osmunda cinnamomea is a fern comparatively rare within fifteen miles of Georgian Bay district and for eight years I scanned and scoured the woods to obtain a forked specimen together with the variety called *frondosa*, but eventually I obtained both within twenty feet of each other from a couple of wayside plants within six miles of the Bay. The forked specimen is very handsome, each branch or fork being quite fifteen inches long from the crotch and the top measuring twenty-two inches across, while the *frondosa* specimens show nicely their condition between half fertile and half sterile fronds.

In a previous number of the FERN JOURNAL I spoke of an interesting locality for *Cystopteris bulbifera* but none of the specimens were illustrated, therefore, I send one plate containing five specimens. They are not the nicest I have by any means, but the center specimen may be of some interest as it contains but five pair of pinnae,

the lower pair measuring fourteen inches across while the total length of the frond is but eight inches, a wonderful contrast to extreme specimens of this fern which sometimes attain a length of over five feet. (Illustrated on Plate 8.)

Note: if the foregoing items meet with a kindly reception and prove of sufficient interest, encouraging others to tell us of their finds, I shall perhaps, at another time, mention some additional types that one would not label as common. My *Cystopteris bulbifera* freak forms would, I think, probably appeal to, and be of interest to anyone who loves the beautiful in plant life.

OWEN SOUND, ONT.

Does Field-work reveal Botrychium dissectum as a sterile Mutant?

HENRY MOUSLEY

The question in the title is based on the article by E. J. Chamberlain in the *Botanical Gazette,* vol. lxx, no. 5, Nov., 1920, under the title "Grouping and Mutation in Botrychium," in which Prof. Chamberlain, after giving certain field data, makes the suggestion that *B. dissectum* is a sterile mutant from *B. obliquum.* Previous to the publication of the above article, I had already, in 1919, at the suggestion of the late James M. Macoun, started to study and collect the various species and forms of Botrychium that grow at Hatley, in view of the little that is known of their distribution in the Province of Quebec. Indeed, before I discovered *B. obliquum* and the var. *dissectum* at Hatley on December 21st, 1918 (Can. Field-Nat. vol. xxxiii, 1919, no. 5, p. 97), they were unknown in the Province, and for this reason, Mr. Macoun had asked me to collect them somewhat generously. This I did (as they grow abundantly here), so that by the time Prof. Chamberlain's paper appeared, I

Forms of Cystopteris bulbifera

was not exactly a novice, although I had certainly never made definite counts, nor plotted charts of the plants as they grew. Still, I knew from experience that as a rule *B. obliquum* invariably grew in groups, *i.e.*, whenever one plant was found, others would almost surely be located in the immediate neighborhood, and that *dissectum* never occurred except in association with *B. obliquum*, and at that date, also, had always been found in smaller numbers.

After reading Prof. Chamberlain's paper, a copy of which he kindly sent me, I set to work to see how far his field data of the two at Oberlin, Ohio, agreed with mine at Hatley, Quebec. In this connection, I was brought in contact with thousands of plants, and have had the satisfaction of finding all the abnormal forms of *obliquum* figured in the two plates accompanying Dr. Chrysler's interesting paper, "The Fertile Spike in Ophioglossaceae" (Annals of Botany, vol. xxiv, no. xciii Jan., 1910)—plants with two and even three fertile spikes, as well as fertile pinnae on the sterile segment, etc. In addition to these, I have a photograph showing the roots of both *obliquum* and *dissectum* so interlocked that at first sight I took them to be growing from the same rootstock, but on closer examination, it was found that they could be separated from one another. The late J. M. Macoun wrote me not so long before his death that a friend of his had actually found both growing from the same rootstock. I also came across some interesting plants with two leaves showing various stages of transition from a primordial leaf with few and large segments, to a more mature one, with many and smaller segments. As the plant grows here, I feel sure *dissectum* is merely a laciniated form of *B. obliquum*. It is, of course, the nomenclatorial type of the species, but that is merely because it happened, quite by accident, to have been first described and named and gives it no

claim to be considered the genetic type, *i.e.*, the more primitive plant.

However, to return to Prof. Chamberlain's paper, it will be noted that in general he speaks of *B. obliquum* as being a larger plant than *dissectum*, his finest example measuring 35 cm. in height, with a leaf 20 cm. in width, while the tallest *dissectum* was 28 cm. Speaking generally, I find that *B. obliquum* as found here is also a larger plant than *dissectum*, my tallest example of the former measuring 27 cm. with a leaf 12 cm. in width, while that of the latter measured 25 cm., with a leaf 10 cm. in width. Abnormal forms of the latter also are much rarer, a plant with three fertile spikes never having been found, while those bearing two have only been met with on rare occasions, although they occur commonly in *obliquum*, and even plants with three fertile spikes are really not so rare. It appears that the total number of *dissectum* plants found by Prof. Chamberlain in his twenty-four plots was only 19, as against 482 of *B. obliquum*, a ratio of 25:1. At first my experience was very similar to Prof. Chamberlain's, until September, 1922, when I discovered a new locality which entirely altered the aspect of things. Here, in four small plots, I actually found forty-four plants of *dissectum* to fifty-four of *obliquum*, in one instance *dissectum* far outnumbering *obliquum*. In the first plot, which was 24 ft. by 10 ft., there were 12 plants of *obliquum* to 3 of *dissectum*, or a ratio of 4:1. In the second plot, which was 20 ft. by 12 ft., there were 17 plants of *obliquum* to 11 of *dissectum* (two of these with fruiting spikes), or a ratio of only 1.5:1. In the third plot, which was only 7 ft. by 5 ft., there were, strangely enough, just 17 *obliquum* and 11 *dissectum*, the same as in the previous case, the ratio of course being the same, 1.5:1. In the last, but by far the most interesting plot, *dissectum* actually outnumbered *obliquum*, there being 19 plants

of the former (7 of which bore fruiting spikes) to 8 of the latter, or a ratio of 2.4:1 in favor of *dissectum*, the size of the plot being 13 ft. by 6 ft.

Taking these four plots, and especially the last one, does it look as if *dissectum* was a sterile mutant? Of the very large number of plants I have seen in the field, I must say I have not noticed any particular sterility in *dissectum*, the above instance forming a good example, where out of 19 plants, 7 bore fruiting panicles! These, as well as those in plot no. 3, were growing on the edge of a cedar wood, amongst short grass and low-lying plants such as partridgeberry, gold-thread, wild strawberry, hair-cap moss (*Polytrichum commune*), and some of the smaller antennarias. Those in plots nos. 1 and 2 were growing amongst much taller and coarser grass and herbage, on the slope of a hilly pasture, in company with several kinds of ferns, blackberry, raspberry and spiraea bushes, pearly everlasting, ground pine, golden-rod, yarrow and hair-cap moss, this latter being usually associated with both *obliquum* and *dissectum*, in fact, I would sooner expect to find them in this moss than in anything else. As regards the fruiting panicles of both, I have carefully compared them together and fail to see that *dissectum* suffers in the comparison, the panicles apparently looking just as lusty as those of *B. obliquum*.

Summing up the results of my five years' intensive work with *dissectum* in the field, I can find no reason, in my humble opinion, for considering it a sterile mutant from *B. obliquum*, nor shall I do so until some one finds out how to germinate the spores and grow the plants, which will settle the question once for all. As this may take many years to accomplish (Prof. Chamberlain has tried it for twenty without success!), we are, in the meantime, perforce obliged to fall back on our field work to guide us in forming an opinion on the matter.

HATLEY, QUE.

Ferns—Facts and Fancies About Them—III

F. E. CORNE

It is estimated that there are about six thousand known ferns. These of course include the tree ferns which in our southern states grow to the height of thirty to forty feet, but in warmer climates, in Australia for instance, are reported to reach the enormous height of seventy and even one hundred feet, and are crowned with immense fronds, some measuring as much as twenty feet in length. From these giants of the fern world it is a long cry to the little *Trichomanes* of Jamaica with fronds no wider than a pencil stroke, or to our own tiny moss-like *Trichomanes Petersii* which is found on the sandstone cliffs of northern Alabama with simple frondlets scarce half an inch high.

Ferns are found in all parts of the world except in the antarctic circle. In the arctic regions only about twenty-five are known, and some of these are much dwarfed in size. Here in New England there are sixty-five to seventy species, and about one hundred more are scattered over the rest of the states. In Great Britain there are only forty-five species, yet it has been well named a "Paradise of Ferns," the number appearing to be much greater on account of the innumerable varieties. For instance the Hart's-tongue, of which we have only one, there numbers over four hundred named varieties, although all are not wild finds; and almost the same can be said of the Lady Fern, Polypody and others.

The humid climate of England seems to tend not only to the growth of numerous varieties, but also to greater size in individual plants. Several writers on New England ferns have expressed surprise that some authors of old England have chosen the Lady Fern as a theme for verse. One writer calls it the "Queen of Ferns." Scott

mentions it by name. Another writer says there is naught growing.

"so fair
As the plumy crest of emerald pale. . . .
Of the Lady Fern when the sunbeams turn
To gold her delicate hair."

Still another writer says that compared to other ferns—

"The palm must still rest with the fair Lady Fern,"

and again,—

"Superb in her beauty beside the full urn,
In the shade of the rock stands the tall Lady Fern."

Now our New England Lady Fern grows only from two to three feet high, occasionally when found in shaded thickets, slightly taller. It is apt to become somewhat shabby in late summer, and one could name more than one superior for beauty and grace. But from old England we have the report of a Lady Fern five feet high, and having one hundred and twenty-five fronds. Truly a very queen of ferns and a fit rival for, say, our stately Royal Osmunda.

The greater number of ferns grow near the equator, and are very prolific in the maritime provinces. In Jamaica over four hundred and seventy are officially reported and I have read somewhere of someone finding over four hundred on one shaded hillside on that island. Almost as many are to be found on the island of Java.

Ferns have adapted themselves wonderfully to changed conditions in the course of ages. The majority of them still prefer the warm moist air of the tropics, and most of those found in cooler climates keep to the still shaded depths of the forest, yet some do almost equally well on the sunny highway. While still others, and these mostly small ones, have climbed to the top of high mountains and there with their tiny roots held fast in the cool moist crevices of the rocks wave their little fronds all day long in the wind and in the full glare of the sun.

As early as the days of Cicero we hear of bowls of fern leaves used for ornament. Thoreau said that nature made ferns "for pure leaves" and a later writer calls them "nature's lace work" and it is chiefly for their beautiful and graceful foliage that the majority of them are prized. Yet some are of a good deal of mercantile value. An oil is made from the rootstock of the Male Fern, Filix-mas, said to be bitter and nauseously sweet which has long been and still is highly valued by physicians as an excellent vermifuge. The roots of this fern, as well as those of the bracken (*Pteris aquilina*), are sometimes used instead of hops in making beer. Baked and ground and prepared in different ways the roots of both plants are used in making lye, glass, soap and flour. In New Zealand and also in Japan some varieties of the bracken are used for making a favorite cake. The young uncoiling fronds also make a good substitute for asparagus. Professor Fernald in his lecture on the "Two hundred edible weeds of New England" told us this, whereupon I tried it. It was quite palatable but tasted to me more like spinach. The Brake and the Male Fern are both said to be full of nitrogen, and also of starch and so are really valuable herbs. The Brake is also said to resist and prevent mildew, and therefore the older leaves are used in Great Britain, where it is very prolific, for packing fresh fish, vegetables and fruit. Also for thatching cottages and as fodder and bedding for cattle. A medicinal syrup is still made in France from the Venus-hair Fern. A species of large fern grows in Hawaii which is so densely covered with fine wool that this is gathered for stuffing pillows and even mattresses.

Some American Indians use the fronds of the fragrant Aspidium in place of tea. Others mingle the stems of maiden-hair, which grows very tall in some localities, with sweet grass in their basket work. The glossy black

stems are effective and beautiful but when dry are too brittle to be practical. In Alaska the Indians dig up before the fronds uncurl a common fern which grows there, smoke and bake it in their ground ovens for their earliest spring vegetable.

The stems of the tree ferns are also highly prized by the natives of the warm countries where they grow, as posts to support their huts and they are considered so invaluable and so indestructible that when a native moves he literally "pulls up stakes" and takes his house posts with him. These stems are also good for making corduroy roads, for fences and for plank walks over otherwise impassable swamps. The rootstalks of some ferns are used for making rope and being impervious to the action of water and not subject to decay are superior to hemp. Still other ferns are pulled into shreds by the natives and are woven into baskets, hats and other things. Inside the stems of tree ferns is a sort of pith which is baked in volcanoes and fed to pigs, and in times of famine is also used for human food.

CAMBRIDGE, MASS.

Some Ferns of Northern New Jersey.

CHARLES S. LEWIS

Among the specimens of Scott's Spleenwort in the herbarium of the Philadelphia Academy of Natural Sciences are some marked "Foul Rift, N. J." Now Foul Rift is a certain rapid not many miles above Easton, and there is a flag station near it on the Belvidere Branch of the Pennsylvania Railroad. So, one morning in mid-June, my son and I set out for a visit to the Foul Rift to find, if possible, Scott's Spleenwort, and whatever else might fall to our lot. It was a wonderful fern trip, even though its primary purpose is still unfulfilled. On the

way up the river we passed the Devil's Tea Table, beneath which is a large station of the Hairy Lip-Fern (*Cheilanthes lanosa*). Just below Philipsburg, the New Jersey town opposite Easton, we passed the Highlands of the Delaware, great towering cliffs, whose faces and the slopes beside them are happy hunting grounds for the fern lover. Alongside the canal which runs at their base we knew were fine stations of the Smooth Cliff Brake (*Pellaea glabella*); and just north great fronds of the Purple Cliff Brake (*P. atropurpurea*) hang over the edge of the opening into Durham Cave.

These familiar treasures did not tempt us and we soon came to the Foul Rift. Which way should we go? Just below the platform the track ran beneath a rock cut for the space of perhaps five or six telegraph poles. That seemed the most promising place and thither we went. Such a wealth of interesting ferns as we found on that limestone cliff and in the woodland glade beyond it! *A. ebenoides* we did not find, though why we could not understand, save that contiguity and apparent opportunity do not always result in the hybrid. All along we found Walking Ferns (*Camptosorus rhizophyllus*) and Ebony Spleenworts (*Asplenium platyneuron*) in abundance. Here they were alone and there together; but no suggestion of a mating between their spores.

Then we found splendid patches of the Rue Spleenwort (*A. Ruta-muraria*) and the Obtuse Woodsia (*W. obtusa*); and fine specimens of the Purple Cliff Brake (*P. atropurpurea*), though none of the Smooth Cliff Brake we knew at the Highlands down the river.

Up over the edge of the cliff in the woods the Marginal Shield Fern (*Thelypteris marginalis*) was fairly abundant and beneath the rocks grew both the Bladder Ferns (*Cystopteris bulbifera* and *C. fragilis*). In the woods beyond were great specimens of the Rattlesnake Fern (*Botrychium virginianum*) in full leaf and with ripened

fertile segments. We recall one specimen bearing two fertile segments, both large and well developed. Here and there were mats of Polypodies (*P. virginianum*) and a good many Christmas Ferns (*Polystichum acrostichoides* and also the var. *incisum*).

Across the tracks and up along the river bank we found the Osmundas (*O. Claytoniana* and *O. cinnamomea*), the Broad Beech Fern (*T. hexagonoptera*), and a bit further along, the Clinton Fern (*T. cristata*, var. *Clintoniana*). The Northern Lady Fern was seen both in the ordinary sun form (*Athyrium angustum*) and the common variety (var. *rubellum*). Maidenhair Spleenworts (*A. Trichomanes*) were frequent under the ledges of the cliff, and the Maidenhair Fern (*Adiantum pedatum*) among the trees above and beyond it. The Spinulose Wood Ferns were rare, the only one found being the common variety (*Thelypteris spinulosa* var. *intermedia*). As usual, the Sensitive Fern (*Onoclea sensibilis*) and the Brake (*Pteridium latiusculum*) were in evidence and we saw plants of the Silvery Spleenwort (*Athyrium acrostichoides*).

Rarely had we had such hunting, but our second day was more remarkable. We crossed into the central portion of the state among the northern lakes and, after a night in the hospitable quarters of the State Y. M. C. A. Camp near Andover, we spent the morning among the limestone ridges along their lake and the afternoon by the swamps on the road into Cranberry Lake and Netcong. The rocks and ridges gave exactly the same group of ferns that we had found at Foul Rift, but with some additions, for we covered a much larger territory. There was one rock face, perhaps three hundred feet long, with a hollow between its base and the ridge opposite, which we particularly recall. Here the Bulblet Bladder Fern grew in such profusion that it covered the lower faces of the rock and the ground at its base in a thick carpet. In

the hollow we found beautiful specimens of the Northern Lady Fern in its several forms (*A. angustum;* var. *elatius;* var. *rubellum;* f. *elegans;* and f. *confertum*). It was a group of the variants of this fern such as we have seldom seen. Then we also saw the two forms, as we always think of them, of the Silvery Spleenwort (*A. acrostichoides*), the big, dark-colored fronds with the silvery indusia and hairs, and the smaller light-colored form which is so confusing in its likeness to the New York Fern and to some forms of the Lady Fern.

In spite of the profusion, here as at Foul Rift, of both the Walking Fern and the Ebony Spleenwort, the latter in the typical form as well as in its variety (var. *serratum*), and their contiguity, we still found no plants of the Scott's Spleenwort. There were remarkable specimens of the var. *incisum* of the Christmas Fern, and an exceptional plant of the true Spinulose Wood Fern (*T. spinulosa*). We found only one of the wood Botrychiums and but two plants of that (*B. ramosum*).

In the afternoon, among the swamps, we added a number of specimens to our list. There was the other Osmunda (*O. regalis* var. *spectabilis*) and in addition to good specimens of the Clinton Fern which we had seen at Foul Rift, we found the Crested Fern (*T. cristata*) and the hybrid, the Crested Marginal (*T. cristata* × *marginalis*). Boott's Shield Fern (*T. Boottii*) was not infrequent and the Marsh Fern (*T. palustris*) and its cousin the New York Fern (*T. noveboracensis*) were abundant. We also found among the rocky pastures plenty of the Hay-scented Fern (*Dennstaedtia punctilobula*).

It was "good hunting," as Mowgli would say, and we came home well satisfied with our excursion to the limestone and lake region of north central New Jersey. We had found thirty-seven species and varieties, even if the

two rarities, the Pinnatifid and Scott's Spleenwort, were still to be found. The list is as follows:

Polypodium virginianum
Adiantum pedatum
Pteridium latiusculum
Pellaea atropurpurea
Asplenium Trichomanes
" *platyneuron*
" " var. *serratum*
Athyrium acrostichoides
" *angustum*
" " var. *elatius*
" " " *rubellum*
" " f. *elegans*
" " " *confertum*
Camptosorus rhizophyllus
Polystichum acrostichoides
" " var. *incisum*
Thelypteris hexagonoptera
" *palustris*
" *noveboracensis*
" *marginalis*
" *cristata*
" " var. *Clintoniana*
" *cristata* × *marginalis*
" *spinulosa*
" " var. *intermedia*
" *Boottii*
Dennstaedtia punctilobula
Woodsia obtusa
Onoclea sensibilis
Osmunda regalis var. *spectabilis*
" *cinnamomea*
" *Claytoniana*
Botrychium ramosum
" *virginianum*

TRENTON, N. J.

ADIANTUM CAPILLUS-VENERIS IN THE KATTSKILLS.—Recently opportunity was offered to look over some fern specimens collected by Miss Clara E. Watkins, of New York City. Most interesting among these were leaves of *Adiantum Capillus-Veneris*, obtained near Windham in the Kattskill Mountain of New York State. The specimens were good sized, mature and fertile. Miss Watkins reported them as obtained from several plants of this species, growing naturally in a rocky, wooded situation. This is not the first occasion in which this species has been reported as native in localities far removed from its usual range in the southern states, but definite localities and specimens appear to be lacking. Clute reports rumors of the occurrence of this fern in New York in his fern book, discounting their accuracy. Taylor, in the "Flora of the Vicinity of New York," makes no mention of the possibility of its representation. This note is included here as a record of Miss Watkins' find, and to stimulate further field investigation. A specimen is deposited in the herbarium of the Brooklyn Botanic Garden.

R. C. B.

We have been told to root out currants and gooseberries to save the white pine, and barberries to protect the wheat; we may yet find some of our beloved ferns under like sentence of death. Three genera of rusts which parasitize ferns are known; of these, all the eight or nine species of *Uredinopsis* and at least one of *Hyalopsora* spend part of their life cycle on firs, where they do much damage to new foliage, especially of young trees, and in one case cause deformation of the host. Two species (one in Europe and one in America) occur on the long beech fern, and others on the European ostrich fern, the west-American bracken (*Pteridium aquilinum*, var. *pubescens*),

the sensitive fern, the marsh fern, the western lady fern, and the western polypody. They attack the balsam fir (*Abies balsamea*) and three western species.[3]

C. A. W.

AN INTERESTING EXTENSION OF RANGE FOR PELLAEA GLABELLA.—In early August of 1923, Rev. W. A. Benfield, Mr. Robert Fleshman, and the writer, in returning from a trip into Mercer County, West Virginia, had to pass through a little strip of Virginia, at Narrows. Here the writer saw some cliffs that looked promising and stopped to investigate, while the others of the party rested in the car. In looking the cliffs over I noticed a fern that I thought might be a small *Pellaea densa* but when I climbed nearer to it I saw that it was something else, possibly only a small *Pellaea atropurpurea*. I collected it, not thinking enough about it to show, or mention it, to the others of the party. It was pressed along with other specimens of the trip and forgotten.

About October, 1923, Dr. Wherry wrote me that he had collected some *Pellaea glabella* in Wisconsin and asked if I would like to have a specimen. I replied that I did not know what it was but would like to have a sample. The moment I saw the specimen I thought of the one collected at the Narrows, Va., in August, so I "dug" it out and sent it to Dr. Wherry, and asked for the "marks" of the species. Dr. Wherry sent the specimen on to Dr. Butters, as it differed from the type. Dr. Butters replied: "I have examined the specimen of *Pellaea* and would unhesitatingly call it *P. glabella*."

This summer, 1924, Rev. Benfield and the writer visited the station to ascertain its extent. We found about a dozen clumps on the cliffs where we had collected it the year before. About 50 meters away another and larger

[3] Bell, H. P. Fern rusts of Abies. Bot. Gaz. 77: 2–31. Pls. I–V, 10 figs. March, 1924.

colony was located. Three days later Dr. Wherry met us at Narrows Station and he took pictures, tested soil, and made notes of this interesting find.

Both stations are on dry, unshaded, limestone cliffs, elevation about 1,700 ft. above sea level.

The nearest stations, so far as known, are in York Co., Pa., and near Clifton, Greene Co., Ohio.—F. W. GRAY, *Cass, W. Va.*

American Fern Society.

To the rather long list of old and valued members whom the Society has lost by death during the year must now be added the name of Rev. John Davis, D.D., who died at Anderson, S. C., his birthplace, July 30, 1924.

Dr. Davis was born May 1, 1850, the fourth successive John Davis in his line of descent. The other three had been physicians; he determined to study for the ministry, and was graduated from the University of the South in 1876 and from Nashotah House in 1879. In the latter year he was ordained a priest of the Episcopal Church. During his ministry he served as Dean of the cathedrals at Dallas, Texas, and Little Rock, Arkansas, and as rector of Trinity Church, Hannibal, Mo., his residence during his later years. In 1895 he went to Tokyo, Japan, as first professor of ecclesiastical history in St. Paul's Theological Seminary there. He remained four years; his lectures were published under the title *Chapters in Ecclesiastical History in Japanese*. After his return, he became dean of the convocation of Hannibal, a post which he held until his retirement in 1919.

"Dr. Davis spoke eight languages and was a student of many sciences." Besides a general interest in botany he had done professional work as a collector for the Missouri Botanical Garden and for the Arnold Arboretum. At least one plant, a species of *Crataegus*, was named for him. He joined the Society in 1909 and was its vice-president in 1915 and 1916.

I have a few specimens of *Woodsia scopulina*, collected in West Virginia by Rev. F. W. Gray which I will distribute to members for postage as long as they last. There is also in preparation a set of forms of the eastern lady ferns for distribution on the same terms. This will be ready during the winter; orders for it may be sent to me at any time.—C. A. WEATHERBY, *11 Wells Ave., East Hartford, Conn.*

REPORT OF THE JUDGE OF ELECTIONS

The members of the American Fern Society have elected the following officers for the year 1925, each one having received one hundred votes.

President, William R. Maxon, Washington, D. C.

Vice-President, Mrs. Carlotta C. Hall, Berkeley, Cal.

Secretary, Charles S. Lewis, Trenton, N. J.

Treasurer, Jay G. Underwood, Hartland, Vt.

(Signed)

EDWARD H. CLARKSON, *Judge of Elections.*

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ERRATA

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VOL. 14, NO. 4

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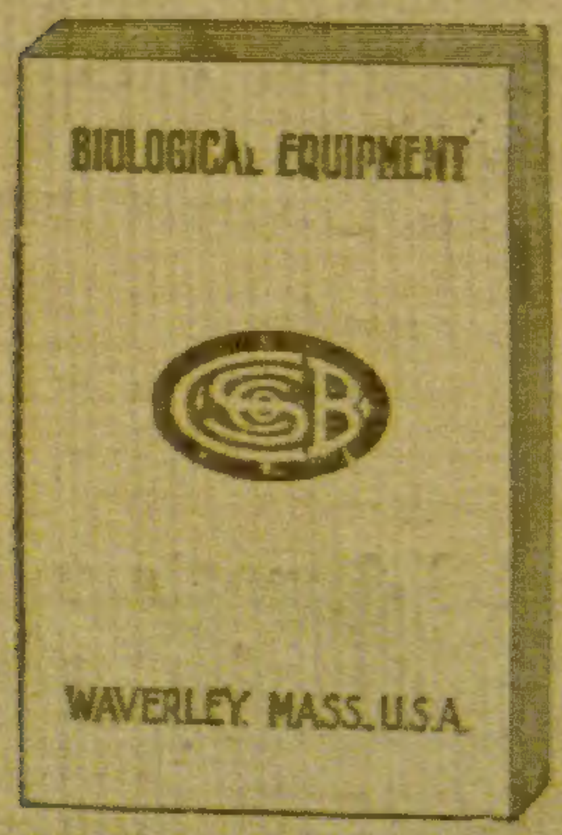

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